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Editorial Notes

The Street Lighting "Let-Up"

SINCE the outbreak of war the "JOURNAL" has urged with seriousness the exercise of patience in regard to the blackout and its amelioration. We have had constantly before us the toll of lives and the number of accidents to which it has given rise. We have commented in these columns on the loss of trade occasioned, the serious personal inconveniences, and, not least, on the serious barrier to educational facilities. We have pointed out that the blackout brought to lighting engineers and physicists an entirely new problem; a problem demanding a new technique for its solution. We asked last week who were to be the arbiters on this problem of wartime lighting, and we pointed out that the task was not one for the Home Office, not for the Gas Industry or the electricity industry, and not for joint committees of the Home Office and representatives of the two industries which supply the energy needed for lighting the streets in peace-time. Judgment, we have urged, must come from the Air Force, and not from lighting engineers.

All the time we have followed closely the experiments which since the beginning of September last have been made on street lighting by low intensity lamps, and the announcement in the House of Commons last week by Sir John Anderson that it has been found possible to devise a type of low intensity lighting which satisfies the Air Ministry is more than welcome and is obviously of the greatest importance to the Gas Industry, which supplies the illuminant for something like three-quarters of a million public lamps in this country. In the experiments which have made this decision possible the Industry, including the manufacturers of equipment, has played a conspicuous part—a part which in the next few weeks the public may not properly appreciate but for which they will have cause to be profoundly thankful.

The experiments to which we refer have been carried out by a joint committee of the Illuminating Engineering Society and the Home Office, which appointed for the purpose a special panel of street lighting specialists and physicists representative of both the gas and the electricity industries. The problem was easy enough to define. It was simply to afford the public the greatest possible amenity at night consistent with maximum safety from attack by enemy aircraft. The problem was not, however, simple to solve; and, as we have said, its solution involved a new technique.

The latest experiment, and the most important, was carried out in the Hendon area and was divided into two parts—main road lighting and the lighting of a residential estate. The level of illumination allowable for main road lighting was exceedingly low. The maximum was 0·0004 foot-candle, and this only over the small area at the foot of each lighting column, the general level of illumination being of the order of 0·0002 foot-candle. Compare this with the level normally associated with main road lighting of the type—namely, Class D of the British Standard Specification, which gives a minimum illumination of 0·2 foot-candle. In other words, the new wartime illumination will be one-thousandth that of normal street lighting. Even the expert found it difficult to visualise such a condition, and few would have been prepared last September to say that such an order of illumination would have any amenity value at all. The intensity of illumination is equivalent only to starlight on a clear night, and its measurement is one of extreme difficulty and nicety.

The other part of the experiment was carried out on the Burnt Oak Estate of the London County Council, and it happens that this estate was in peace-time lighted by gas. It covers an area of a quarter of a square mile, and on it are two types of lighting unit typical of those to be found on residential areas of the kind. One is the familiar panel lamp, the other a typical globe lamp. With panel lamps with sloping sides special precautions are necessary to avoid secondary reflections from the glass passing in an outward direction. No light whatever—this applies to main roads and anywhere else—must be above the horizontal. As is the case in nearly all such areas, the spacing of the lamps on the Burnt Oak Estate was wide, and the maximum illumination permissible was 0·0004 foot-candle, as with main road lighting. The question arose whether with such an intensity and spacing—the illumination between the lamps died down to practically *nil*—the amenity value to be gained would justify the expenditure involved. Results of experiment were, however, astonishing. Experts and others competent to judge were unanimous in their view that the amenity value afforded by such a low intensity was very great indeed.

This "starlight" illumination, it was found, gives the

pedestrians a sense of comfort and confidence. Observation of the effects on the estate showed that the public used torches to nothing like the extent they did previous to the "let-up." There was not the tendency for people to leave the pavement to avoid possible obstruction and walk in the road, at once adding to risk. From the point of view of the motorist—and this applies particularly to main road lighting—it was found that the new lighting gives him a sense of perspective. It may be said that it gives him for driving a dim but invaluable "frame of reference." "Starlight" lighting has been shown to be exceedingly effective, but the pedestrian and motorist alike must continue to exercise care and caution and not become over-confident. "Starlight" lighting is wartime lighting; it has no relationship to peace-time illumination. Last week we said that experience since Sept. 3 has brought a new focus to bear on lighting problems. We referred to the assessment of the relative values of blue and white light and put forward the view that blue light is, on equality of intensity, more penetrative and hence more potentially dangerous than white light. It is also more expensive. It is to be noted that the recommended wartime lighting will be white light—white light carefully controlled. Strict control is the essential feature of the new system of lighting.

We have stressed the part which has been played by illuminating technician and physicist in making possible this wartime lighting amenity. The problem was to spread out the light available in the best way and within fine limits, to make the utmost use of the small quantity of light. It was a problem which demanded for its solution much technical skill and resource. New units had to be developed with suitable light distribution curves, bearing in mind that no light could be above the horizontal. The "run-back" of the distribution curve had to be even. Those who know about "onion diagrams" will understand.

Vigorous control—that is demanded. For which reason a British Standards Specification is to be issued which defines the light distribution requirements. Fittings will have to bear the approval mark of the B.S.I., which body reserves the right to examine samples from bulk delivery. The Gas Industry has certainly nothing to fear from "examination" of the lighting units it can produce, and the public can be assured once again of real gas service. Manufacturers of equipment will get together, quickly and busily, to provide municipalities with the needed fittings. The Industry is well prepared. Time, presumably, is on our side in this war; let us hope that time, on this question of wartime lighting, is taken by the forelock. Every gas undertaking should know (*a*) the number, size, and type of lamps that will be converted in its area of supply; (*b*) the mounting height. This information should be—indeed must be—given to the makers of the fittings which will render "starlight" lighting possible at the present time.

It is anticipated that in a few days' time there will be published a British Standard Specification for Street Lighting under Wartime Conditions which has been prepared by the Joint Lighting Committee of the Illuminating Engineering Society and the Home Office. In the meantime we are able to publish in to-day's "JOURNAL" the draft of this Specification. It should be understood that this draft is still subject to alteration, but no major alterations are expected.

A Measure of Relief

IT has long been realized that the war has made it essential for many undertakings to obtain some relaxation of their dividend and price control provisions. These were not designed to meet the circumstances of war and the heavy and unprecedented rise of costs which hostilities must inevitably entail. Sliding scale provisions, for instance, are intended to encourage good working and economy on the part of gas companies in respect of those conditions which they can control.

In time of war many factors arise which are quite beyond the control of gas companies, but result, nevertheless, in heavily increased costs. In such cases the sliding scale may involve such a reduction in the amount of dividend payable that the value of gas stock becomes artificially and unhealthily depressed. It was to avoid this that the Gas Light and Coke Company, after the last war, obtained from Parliament sanction for a minimum dividend below which the sliding scale could not operate. Since that time, the Gas Light and many other companies have adopted basic price provisions which, although somewhat complicated, have the advantage that, whatever the price of gas, they may under all circumstances pay their basic dividend.

This week has seen the appearance of a new Defence (Gas Charges) Order, which, though it does not apply to basic price companies, should be of considerable assistance to those companies which continue to operate under sliding scale or maximum price provisions. In such cases the company may take advantage of the Order if the fall in the amount of gas manufactured in any quarter is 5% or more below that manufactured in the corresponding quarter of 1938. We must, however, stress the limited scope of the Order, which provides solely for loss incurred by reason of the fall in output. There will, naturally, be many other losses such as those due to the increased costs of raw material and labour, the rise in freights, and the expense of A.R.P. These will not, however, fall within the scope of the Order, but may be the subject of a separate application by each undertaking to the Board of Trade under the Defence of the Realm Regulations.

In respect of the fall in consumption, to which alone the new Order applies, maximum price and dividend as well as sliding scale companies may increase their price in accordance with the scale, based upon the decrease in the amount of gas manufactured, which is contained in the Order. Naturally the increase could only be made after due notice to all consumers. Where advantage is taken of the Order, a company will be entitled to pay a dividend on ordinary stock of 1% less than the average dividend which has been paid during the three preceding years. This will ensure that the sacrifice shall be felt alike by the consumer and the shareholder.

The Order contains some complicated provisions which will apply where the average dividend is around the neighbourhood of 5% or lower than 5%, but it is not, of course, our function to analyze the Order in detail. Further restrictions will also be imposed upon a company which operates the Order with regard to the amounts which may be contributed to their various funds or spent in repairs and directors' fees; and an undertaking which has since the outbreak of war increased its hire charges will be precluded from taking advantage of the Order.

Position of Local Authorities

WITH regard to local authorities, the Order provides that in no circumstances shall a price above the maximum price be charged if the effect would be that the receipts of the undertaking in account of revenue would exceed "the expenditure in respect thereof." As we have emphasized above, the object of the Order is limited to the attempt to rectify the losses resulting from the fall in consumption of gas which is due to war conditions. These losses may fall most heavily upon undertakings in evacuation areas, although they are by no means restricted to those areas. Many undertakings in neutral and even reception areas have experienced a serious decline in consumption, which has not been checked by the increase in the ration from 75% to 100%. There remains the further question of rising costs which will inevitably impel many undertakers to seek a revision of their statutory powers. Fortunately in order to grant this it is no longer necessary for the Board of Trade to make a Special Order since the Defence of the Realm Regulations permit the necessary adjust-

ment to be carried out by Departmental orders which do not need to be laid before Parliament. Even so, however, it is difficult to see how the Board of Trade can possibly deal quickly and expeditiously with each case, involving, as it inevitably must, a careful investigation of local circumstances and conditions. It is therefore worthy of consideration whether a further general Order should not be made authorizing increases in respect of rising costs which are experienced not only by these undertakings which are able to take advantage of the new Order, but by every public utility throughout the country.

Compressed Gas for Motor Transport

A REPORT will be found on later pages of a discussion on a Paper presented last week by Dr. J. S. Clarke, of the Birmingham Gas Department, to the Institution of Automobile Engineers. His subject was on the use of gas as a fuel for motor vehicles—a problem to which, as our readers are aware, Birmingham has devoted years of important and successful research. As we have pointed out, there are now no technical difficulties to the use of compressed gas for motor transport. In certain circumstances the substitution of town gas for imported fuel has been worked out as a reasonable economic proposition in peace-time. Wartime conditions, as we have said, have put an entirely different aspect on the whole problem, and we have emphasized a fundamental point which appears to be overlooked when the matter is being discussed. That is that commercial firms, owing to lack of petrol, may have part of their transport fleet lying idle. They can turn to gas as a substitute and resume operations.

Normal comparisons of the relative costs of gas and petrol do not apply under war conditions, and, what is also important, there is now a concession of tax on the unladen weight of vehicles to exclude the weight of the necessary gas equipment. For the purpose of computing the rate of duty chargeable, the unladen weight of vehicles carrying gas containers (this applies also to producer gas plant) will be reduced by from half-a-ton to one ton, according to size. Trailers used solely for carrying gas cylinders will not be charged with duty. The amended rates of duty chargeable on vehicles not exceeding a ton and a half in weight unladen will be: Under 12 cwt., £10; exceeding 12 cwt. but not exceeding one ton, £15; and exceeding one ton but not exceeding a ton and a half in weight, £20. Compressed gas is a practical fuel for motor vehicles. Capital charges are admittedly high, but these should be reduced with any large-scale development. It can, however, be taken that gas at 5d. a therm at inlet to compressors shows a saving in fuel cost per vehicle mile compared with petrol at prices ruling to-day.

There was testimony during the discussion on Dr. Clarke's Paper to the economical and trouble-free running of commercial vehicles on gas, and Colonel W. M. Carr contributed an interesting account of developments resulting from application of the Erren principle. One speaker referred to a matter which certainly should be made clear by those in authority. He has had the unpleasant shock of being informed that the basic petrol ration for two lorries which he has had converted to running on gas has been withdrawn, and this has modified his decision to convert further lorries to gas. We have reason to believe that others have held up their decision to use gas because of this question of basic petrol allowance. Help and encouragement in developing the use of compressed gas for motor transport have been scanty enough, but surely this is not the time for any item of policy tending to retard this use.

Personal

Following upon Mr. W. J. SANDEMAN'S retirement at the end of the year from the position of General Manager of the Croydon Gas Company, Mr. W. GROGONO, hitherto Engineer, has been appointed Engineer and General Manager, while Mr. J. M. WEBBER becomes Deputy Engineer, and Mr. P. RICHBELL Distribution Engineer.

Obituary

The death has taken place of Mr. J. D. NICOL, who was a Director of the Kinghorn Gas Company.

Forthcoming Engagements

1940.

Jan.

9.—N.G.C.—Central Executive Board, 11 a.m.

27.—Yorkshire Junior Gas Association.—Meeting at Leeds. Presidential Address of T. G. Lewis.

31.—Conjoint Conference of Public Utility Associations.—Eighth Annual General Meeting, Gas Industry House, 3 p.m.

Amalgamating and Grouping

Newcastle and Morpeth

The Newcastle-upon-Tyne and Gateshead Gas Company is to promote a Bill for the purpose of acquiring the Morpeth Gas Light Company (1920), Ltd.

Standard Unit for Street Lighting Under War-time Conditions

As a result of the work of the Joint Lighting Committee of the Illuminating Engineering Society and the Home Office, a provisional specification in connexion with war-time street lighting, giving details of intensity and light distribution, has been prepared. This is published in to-day's "JOURNAL."

Members of the Society of British Gas Industries concerned have been carrying out experimental and investigatory work to meet the demand for an appropriate unit, and now that permission for its use is likely to be granted shortly by the Ministry of Home Security, the following makers are completing their plans to go into production at the earliest possible moment with an improved standard unit based upon the provisional specification which has been issued:

William Edgar & Son, Ltd.,
Falk, Stadelmann & Co., Ltd.,
Foster & Pullen, Ltd.,
Keith Blackman, Ltd.,
C. H. Kempton & Co., Ltd.,
Wm. Parkinson & Co.,
Wm. Sugg & Co., Ltd.

There are a number of difficult problems in connexion with the supply of the necessary material to be faced, and the makers concerned have agreed together virtually to pool their resources so that the potential demand may be met as effectively and speedily as possible. Gas undertakings may look to any of the firms concerned with whom they normally do business for their requirements to be supplied, but the rotation in which orders will be executed may depend upon several factors on which the makers are awaiting information and instructions. In fact, the general Order permitting restricted street lighting has not yet been issued. Every standard unit made has to be passed by approving authorities which are being appointed, and manufacture will therefore be carefully controlled.

We shall publish such further announcements as circumstances may render desirable to keep gas undertakings generally advised of developments. It will help all those who are endeavouring to cope at very short notice with this new and important development if, for the present, gas undertakings will kindly accept these announcements as the recognized channel of information.

News of the Week

Two Motor Buses in Wallasey are to be adapted for gas propulsion, and if they prove satisfactory a further five vehicles will be similarly dealt with.

A Rest Room for the Forces, comprising a local club, has been fully equipped with gas fittings free of charge by the Berwick and Tweedmouth Gas Light Company.

Buses Running on Gas are now in public service in the Nottingham District. They belong to Barton Transport, Ltd., and are capable of travelling some 40 miles on one filling.

A Draft Special Order under the Gas Undertakings Acts, 1920-1934, has been presented by the Board of Trade to enable the Newcastle-under-Lyme Corporation to take a supply of gas in bulk from the Birchenwood Gas and Coke Company, Kidsgrove.

Copies of the Following recently issued British Standard Air Raid Precautions Series Specification can be obtained, price 8d. each, post free, on application to the Secretary of The Institution of Gas Engineers, 1 Grosvenor Place, London, S.W.1: BS/ARP 32. Illuminated and non-illuminated A.R.P. signs. (November, 1939).

The Gas Section of the Board of Trade is now situated at the main office of the Board at Great George Street, S.W.1, Rooms 57, 57a, and 58, and on the ground floor.

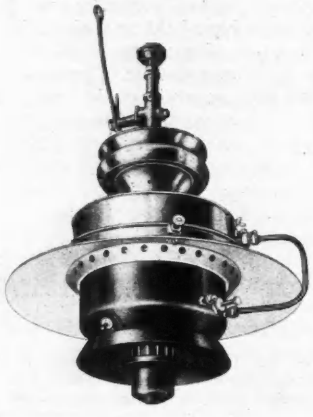
We Have Received from the Department of Scientific and Industrial Research a copy of the National Physical Laboratory Abstracts of Papers published in the year 1938. This publication is obtainable from H.M. Stationery Office, price 1s. net, postage extra.

The First Goods Transport Vehicle to operate on coal gas in Cleethorpes is being run by the Cleethorpes Gas Company. It is an 8-cylinder two-ton lorry which is engaged on regular delivery work. Filling facilities are already available at various points in the district.

The Bristol Branch of the Coal Utilisation Joint Council has been transferred from its present Office in Baldwin Street, Bristol. The new address of the Branch will be: Coal Utilisation Joint Council, c/o. Mr. G. H. Barnard, 18, Glen Drive, Stoke Bishop, Bristol, 9. Telephone No.: Bristol 81022; telegrams: Promocoal, Bristol.

Approved A.R.P. Street Lighting

Reference is made in our editorial columns to-day to Sir John Anderson's announcement last week regarding permissible street lighting. Our photograph shows a Sugg conversion unit fitted to a "Littleton" suspension lamp, to give the standard of lighting officially sanctioned.



A.R.P. Lighting Unit by Sugg

The conversion unit consists of a separate burner together with a combined "reflector and absorber" unit. The distribution is designed to give an illumination of approximately 0.0002 horizontal foot-candle.

In the case of the "Rochester" and "Littleton" lamps, the unit is designed to drop through the globe carrier, and the gas supply is connected externally to the ejector of the lamp.

By a simple adaptor the same type of unit can be applied to the modern high power suspension lanterns of the "London" type, and a further unit employing the same source and "reflector-absorber" unit has been designed for square and circular lanterns.

In the case of square lanterns it is necessary to fit a 4-way baffle beneath the unit, to prevent light reflected internally from the inclined glass panes being thrown above the horizontal.

Further Price Increases

In addition to the increases in the price of gas by various undertakings, referred to already in these columns, the under-mentioned advances have also been announced:

Auchtermuchty.—By 5d. per 1,000 cu.ft.

Belfast.—By 2½d. (gross) or 2d. (net) per 1,000 cu.ft.

Coldstream.—By 7½d. per 1,000 cu.ft.

Greenock.—By 3d. per 1,000 cu.ft.

Hamilton.—By 5d. per 1,000 cu.ft.

Kilmarnock.—By 8d. per 1,000 cu.ft.

Radcliffe.—By 0.7d. per therm for ordinary consumers; reduced rebate for slot consumers; 1d. per therm increase on two-part tariff.

Retford.—By 1d. per therm.

Wallasey.—To 9.25d. per therm. This is the first price increase for twelve years.

Yorkshire Junior Gas Association

Activities to be Continued

A meeting of the Council of the Yorkshire Junior Gas Association, presided over by Mr. A. Wylie (the President) was held at the Great Northern Hotel, Leeds, on Dec. 7.

There was a full attendance of the members of the Council, and the following resolutions were unanimously agreed to:

1. That the activities of the Association be carried on as far as possible during the war period.
2. That the election of new Officers, the presentation of the Balance Sheet, and the Address by the President-Elect (Mr. T. G. Lewis, of Leeds) should take place in Leeds on Saturday, Jan. 27, 1940.
3. That a meeting be held one Saturday afternoon during the months of February, March, April, and if possible, May.
4. That these meetings take place in either Bradford or Leeds as the most convenient centres to the majority of members.

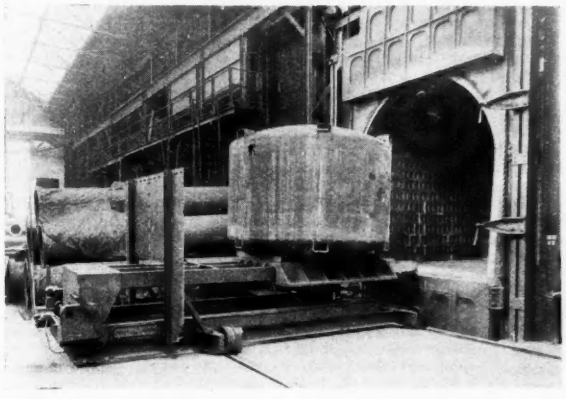
Successful Demonstrations at Leamington

The Leamington Priors Gas Company held a series of war time cookery demonstrations recently, in conjunction with John Wright & Co., Ltd., and Sidney Flavel & Co., Ltd. The demonstrator was Miss Zita Fitzgerald, of the Radiation Research Kitchen, and the attendances throughout the week, notwithstanding the fact that the audience had to return to their homes in semi-darkness, constituted records. On every day the hall, which had seating capacity for 240, was filled, and every day at least 50 were turned away. The cake-baking competition proved an enormous success, and there were 204 entries. The accompanying photograph shows the Chairman of the Company, Dr. Harold Mason, M.B., with the demonstrator, congratulating the winners in the competition.

Mechanical Furnace Charging Machines

THE use of mechanical charging equipment is rapidly becoming more prevalent among furnace operatives, since manual manipulation of cumbersome loads is eliminated, thus reducing fatigue, and saving much valuable time. Transportation and handling is simplified, production increased and labour costs reduced.

Mechanical charging machines—arranged for both hand and electrical operation—are manufactured to meet a wide range of conditions. For instance, the "Duplex" type, designed for extra-rapid working with vitreous enamelling furnaces, consists of two single machines coupled together to form one unit. The load to be treated is placed on one pair of forks, and the load already



under treatment is withdrawn from the furnace on the other pair. The new load may then be charged without delay. Other machines have been designed on the swivel principle for transferring loads from a position out of line with the furnaces, as the forks may be turned through an arc of 180°. Machines have also been designed for completely automatic operation by electrical push button control, and for handling loads over an extensive reach—up to 30 ft.

The accompanying illustration shows a three-fork hand-operated charging machine, for charging steel tanks up to four tons in weight. It is of the cantilever type, and has a reach of 13 ft.; an overall length of 17 ft. 6 in.; an overall width of 6 ft. 8½ in.; and a height above floor level of 3 ft. 3½ in. The centres of the road wheels are 11 ft. apart.

The method of charging is as follows. The load is placed on the detachable furnace floor section, which in turn, rests on the charging forks. The load is then charged into the furnace, and the forks lowered and withdrawn from under the furnace floor. Upon discharging, the forks enter the furnace between the slots in the underside of the floor; the whole is then lifted bodily and withdrawn from the furnace. The machine is a good example of a modern hand-operated charger. For many classes of work equipment of this type is indispensable to meet the need for speedy handling of components to be heat treated.

Full details of the latest type of furnace charging machines are given in three new leaflets issued by the Incandescent Heat Co., Ltd., of Cornwall Road, Smethwick, Birmingham.

J. Brockhouse and Co., Ltd.

Consistent Progress

The 42nd Ordinary General Meeting of J. Brockhouse & Co., Ltd., was held at West Bromwich.

Mr. J. T. Brockhouse, J.P. (Chairman and Managing Director), said that it was very pleasing to be able to present such a gratifying report, constituting as it did a record in the history of the company, which had now been in existence for some 53 years. Since their accounts were made up to the end of September, it could not be said that the increase was the result of the declaration of war. Rather was it due to the enormous expansion of their business and the efficiency of their works. Their turnover had increased 4½ times during the last five years and, although their main works had shown the greatest increase, with only three exceptions every branch and subsidiary company had shown a substantial rise in turnover. The profit on that turnover was normal or even moderate, and the net result could be put down to the genuine expansion of the business.

The available balance was £269,458, and they proposed to pay a dividend of 12½%, less tax on the ordinary stock, making 20%, less tax, for the year. Notwithstanding the wonderful record of the past year, under present conditions there was no reason to think that it could not be exceeded during the coming year.

Gascoignes (Reading), Ltd.

A Record Profit

The Third Ordinary General Meeting of Gascoignes (Reading), Ltd., was held at Reading.

Mr. G. H. Gascoigne, M.I.Struct. E. (the Chairman and Managing Director), who presided, said that the period covered by the accounts had been one of uncertainty and anxiety, but nevertheless the Company had had a very successful year, and, in spite of rising costs of production, difficulties experienced at times in obtaining supplies and labour difficulties, a record turnover and profit had again been achieved.

The net profit for the year had amounted to £14,230, as against £13,331, and the directors recommended a dividend of 12½%, or the same rate as in the previous year. The financial position disclosed by the balance sheet was one of great strength, as, after providing for the dividend recommended, there would be an excess of liquid assets over liabilities of £44,638, or nearly 90% of the issued capital.

The Directors were of the opinion that the progress shown in the period under review would be maintained in the coming year. In order to cope with the increasing turnover, the Directors had decided to erect a new factory. A freehold site had been acquired in Reading and work thereon had been commenced. In order to provide the necessary expenditure and additional working capital, the Directors proposed to ask the consent of the shareholders in the near future to the increase in the authorized share capital to £100,000. Subject to the consent of the Treasury it was proposed to issue £25,000 of shares on favourable terms to the shareholders.

Gas Producers for Use on Vehicles

As announced in Parliament on Nov. 8 both by the Lord President of the Council and the Secretary for Mines, a design of producer gas generating apparatus suitable for use with road transport vehicles has been developed, and will be made available to firms able and willing to undertake manufacture. All enquiries about this apparatus should be addressed in the first instance to the Director of Fuel Research, Fuel Research Station, River Way, Blackwall Lane, E. Greenwich, S.E.10.

Firms interested in the possible manufacture of the producer should give some indication of the manufacturing facilities they have available and the type of work on which they have had previous experience. The design in question has been prepared for large scale production involving the use of steel pressings.

A Topical Display

This topical war-time display was produced by the Display Artist of the Portsmouth and Gosport Gas Company and has appeared lately in their showrooms.

The Defence (Gas Charges) Order

Made by the Board of Trade and dated Dec. 2

The Board of Trade, in pursuance of Regulation 56 of the Defence Regulations, 1939(a), hereby order as follows:

1.—(1) Where:

(*a*) there apply to any undertakers any provisions of an enactment prescribing the maximum price which may be charged by them in respect of gas, and

(*b*) the quantity of gas manufactured in any quarter by the undertakers did not exceed 95% of the quantity manufactured in the corresponding period in the year 1938,

nothing in those provisions shall prevent the undertakers charging consumers in respect of gas supplied to them during the next succeeding quarter a price not exceeding the permitted price in respect of that quarter:

Provided that in the case of undertakers, being a local authority, no price exceeding the said maximum price shall be charged such that it appears to the undertakers that the receipts on account of the revenue of the undertaking will exceed the expenditure in respect thereof calculated in accordance with this Order and with any enactment prescribing the form of accounts to be kept in relation to the undertaking.

(2) In the case of undertakers, being a company, where in any financial year of the company a price exceeding the maximum price prescribed by any enactment relating to the undertakers is charged, no sum, being a sum which may be divided among the holders of the share capital of the company, shall be taken from the profits of the undertaking in respect of that financial year exceeding the aggregate of amounts calculated at the following rates on so much of the authorized share capital of the undertaking as is issued, that is to say:

(i) in respect of preference share capital at the rate of dividend fixed in respect of such capital, and

(ii) in respect of each class of ordinary share capital at a rate equal to 1% less than the average of the rates of dividend paid on that capital in respect of the financial years of the company ending in 1936, 1937 and 1938, or, where the rate so determined is less than 5%, at a rate equal to the said average or 5% whichever is the less.

(3) Where:

(a) there apply to any undertakers, being a company, the provisions of an enactment prescribing a standard price in respect of gas supplied by the undertakers and providing for variations in the amount which may be taken from the profits of the undertaking for division among the holders of the share capital of the company according to the highest price actually charged by them in respect of gas, and

(*b*) the quantity of gas manufactured in any quarter by the undertakers did not exceed 95% of the quantity manufactured in the corresponding period in the year 1938,

for the purpose of determining under those provisions the amount which the undertakers may take from the profits of the undertaking for division among the holders of share capital of the company in respect of any financial year of the company, the undertakers shall not be required to take into account such part of the price charged by them for gas during the quarter next succeeding that aforesaid as exceeds the pre-war price but does not exceed the permitted price in respect of that quarter:

Provided that the undertakers shall not, by virtue of this provision be entitled to take from the profits of the undertaking for this purpose a sum exceeding the aggregate of amounts calculated at the following rates on so much of the authorized share capital of the undertaking as is issued, that is to say:

(i) in respect of preference share capital at the rate of dividend fixed in respect of such capital, and

(ii) in respect of each class of ordinary share capital at a rate equal to 1% less than the average of the rates of dividend paid on that capital in respect of the financial years of the Company ending in 1936, 1937 1938 or, where the rate so determined is less than 5%, at a rate equal to the said average or 5% whichever is the less.

(4) For the purposes of this paragraph, the permitted price in respect of any quarter shall be calculated in the following manner by reference to the percentage which the quantity of gas manufactured by the undertakers in the last preceding quarter is of the quantity manufactured by them in the corresponding period in the year 1938, that is to say:

To the pre-war price there shall be added $\frac{1}{10}$d. per therm in respect of each quantity equal to 1% of the quantity manufactured in the corresponding period by which the quantity manufactured in that quarter is less than that manufactured in the said corresponding period.

So, however, that in relation to undertakers who are not authorized to charge for gas according to the number of British Thermal Units supplied this paragraph shall have effect as if "$\frac{1}{2}$d. per 1,000 cu.ft." were substituted for "$\frac{1}{10}$d. per therm."

(5) The powers conferred by the preceding provisions of this paragraph shall not apply to any undertakers in relation to any quarter during which the charges made by them for the hire of any meters or fittings are or were in excess of the charges current in respect of those meters or fittings on Sept. 2, 1939.

2. In respect of any financial year of an undertaking during which or in respect of which anything is done by the undertakers by virtue of the powers conferred by the preceding provisions of this Order, the following provisions shall have effect:

(*a*) No appropriation shall be made out of the revenues or profits of the undertaking to any fund for reserves, renewals, special purposes or the like objects exceeding an amount equal to the average of the appropriations made to that fund in respect of the financial years ending in 1936, 1937, and 1938;

(*b*) Except with the consent of the Board of Trade no sum shall be charged against the revenue of the undertaking in respect of the repair or maintenance of the works or plant thereof exceeding an amount equal to the average of the amounts charged in respect of the financial years ending in 1936, 1937, and 1938;

(*c*) In the case of undertakers being a company, no sum shall be charged against the revenue of the undertaking in respect of the remuneration of the directors of the company exceeding the amount charged in respect of the financial year ending in 1938.

3. Upon the coming into force after the date of this Order of an enactment relating to any undertakers, being an enactment which fixes or amends a maximum price or standard price in respect of gas, the powers conferred by this Order shall cease to be exercisable by those undertakers.

4.—(1) In this Order—

The several words and expressions to which meanings are assigned by the Gas Undertakings Acts, 1920 to 1934, shall have the same respective meanings unless there be something in the subject or context repugnant to such construction, and "pre-war price" means the price stated by the undertakers in the notice current on Sept. 2, 1939, for the purposes of Section 6 of the Gas Undertakings Act, 1934(a), or if there be no such notice the highest price lawfully charged by the undertakers for gas supplied on that date.

(a) S.R. & O. 1939 No. 927.

(a) 24 & 25 Geo. 5. c. 38.

Women's Gas Council

Cardiff Members Do Their Bit

The Cardiff Branch of the Women's Gas Council have hit on the idea of adopting a ship and supplying the needs of the men aboard her. In this idea they had the support of the chaplain of the Cardiff Missions to Seamen, and the ship which was put in their care has now been changed into a minesweeper. When the ship set out in its new capacity last week the knitting section of the council despatched a package containing fifty comforts for the men.

Another group of members has been doing good work in the way of sewing for the military beds at the Cardiff Royal Infirmary.

National Gas Council

Meeting of Central Executive Board

A meeting of the Central Executive Board of the National Gas Council was held at Gas Industry House on Dec. 12. The President, Sir David Milne-Watson, Bart., LL.D., D.L., was in the Chair.

The resignation of Mr. W. J. Sandeman, M.Inst.Gas E., J.P., General Manager of the Croydon Gas Company, was reported. The Chairman referred in enthusiastic terms to the valuable services rendered to the Gas Industry by Mr. Sandeman who was one of the original members of the National Gas Council when it was formed in 1915. The Chairman said that he had been a staunch and loyal supporter of the Council and he would be greatly missed by his colleagues on the Board.

A letter was submitted from Mr. C. Rhodes Armitage, M.Inst.C.E., M.Inst.Gas E., Engineer and Manager of the British Gas Light Company, Hull. The Chairman paid tribute to the services rendered by Mr. Rhodes Armitage and said that his resignation from the Board would be felt keenly by his many friends.

National Emergency

Coal.—The general position with regard to coal for gas undertakings throughout the country was considered, together with the transport question. The views of the various districts having been expressed, officers were instructed to take certain steps in connexion with the various problems referred to.

Coke.—The general position with regard to coke supplies throughout the country was discussed, and the steps being taken by the National Federation of Gas Coke Associations to deal with the matter was reported.

Price of Gas.—The difficulties which gas undertakings were experiencing throughout the country, as a result of decrease in consumption, rise in costs in coal and commodities, and especially high freightage charges as it affected the price of gas, were discussed. Reference was also made to the necessity of obtaining orders from the Board of Trade, expeditiously under Section 1 of the Gas Regulation Act, 1920, and orders under Section 10 relating to increased capital charges.

The Control of Toluene (No. 1) Order, 1939, was considered and the necessity for the production of this material by all gas undertakings. The matter was referred to the Emergency Committee with power to co-opt.

Issues of Capital and Capital Expenditure

A letter and enclosure from the Director of Gas Administration of the Board of Trade, dated Nov. 27, 1939, were submitted with regard to the necessity of conserving the capital resources of the country and the position was considered in relation to its effect upon the Gas Industry.

Fuel and Lighting Order, 1939

It was reported that the Joint Gas and Electricity Committee had met the Secretary for Mines and submitted to him a memorandum embodying the various recommendations contained in their report.

Conjoint Conference of Public Utility Associations

It was reported that the Eighth Annual General Meeting would take place at Gas Industry House on Wednesday, Jan. 31, 1940, at 3 p.m., when it was expected that the President (Lord Falmouth) would preside.

The Board nominated the following representatives to serve on the Council of the Conjoint Conference—namely:

R. Halkett, M.Inst.Gas E.
T. Hardie, M.Inst.C.E., M.Inst.Gas E.
A. W. Smith, F.C.I.S., Hon.M.Inst.Gas E.
H. C. Smith, M.Inst.C.E., M.Inst.Gas E., J.P.
Jas. Jamieson, M.Inst.Gas E.

It was explained that in view of the large number of municipal duties which had now to be carried out by Sir William Kay, it was very difficult for him to attend meetings of the Conference. It was, therefore, decided to ask Mr. Cadman to act in place of Sir William Kay.

Federation of British Industries

To Main Group 9, Section 1 (Chemical Fertilisers and Explosives).—Mr. E. V. Evans and Mr. R. W. Hunter were nominated to serve on this section for another year.

To Main Group 14, Sub-group 3 (Public Utilities).—Mr. John Terrace, Mr. H. C. Smith, and Mr. S. S. Ogilvie were nominated to serve on this Group for another year.

It was decided that the next meeting should be held on Tuesday, Jan. 9, 1940, at 11 a.m.

Alternative Fuels for Motor Transport

It was reported that in accordance with the resolution of the Board, a communication had been sent to the Ministry of Transport drawing attention to the higher rate of licence duty payable where vehicles were converted from the use of petrol to the use of gas and pointing out that this was exercising a retarding effect upon the use of alternative fuels.

It was with satisfaction that the Council were able to report that the Chancellor of the Exchequer had decided to make concessions on excise duty for goods vehicles run on gas. These proposals would be submitted to the House of Commons and become operative on Jan. 1. The new rates are identical to those applying to petrol-driven goods vehicles.

The difficulties experienced with regard to obtaining adequate petrol rations where vehicles partly operate on coal gas were considered.

It was pointed out that any regulation which prevented the full use of roads for transport purposes at the present time was likely to be damaging to the country's interests, and the matter was left in the hands of the officers to deal with in the way they thought most appropriate.

War Damage to Real Property

The report of the Committee set up by the Government presided over by Lord Weir "to examine the practicability of evolving any scheme for mutual protection against the risk of war damage to fixed property in private ownership" was considered.

It was further stated that the Government had set up another Committee under the Chairmanship of Mr. Andrewes Uthwatt "to advise as to general principles on which physical damage to general property arising from enemy action should be assessed by the Compensation Board" which is to be set up. It was stated that the Government scheme was not intended to extend to real property belonging to public utility undertakings, in regard to which special arrangements would be made. It was unanimously agreed to refer the matter to the Conjoint Conference of Public Utility Associations.

Plymouth Gas Price

War conditions have resulted in the City of Plymouth having to abandon their hope of still further reducing the price of gas, which they have been proud to claim as among the cheapest in the country.

A statement regarding the position was made by the Chairman of the Gas Committee (Sir Clifford Tozer) at a meeting of the City Council on Dec. 4. He said the Corporation had been supplying gas at one of the lowest prices in the country, and it had been hoped that it would be possible to reduce even that low price. Unfortunately, through circumstances over which they had no control, they were now in the position that it was imperative that the price of gas should be raised if they were to end the twelve months in a satisfactory financial position. The main reason that was necessary was the increased price of coal, largely due to war freightage. If they continued to supply gas at the present price of 2s. 6d. per 1,000 cu.ft. it would be impossible to end the financial year without showing a loss of £12,000. By the proposal, announced in last week's "JOURNAL," to increase the price by 6d. to 3s. per 1,000 cu.ft.—which will still be below the present average price for the whole country—it was hoped to reduced the anticipated loss to £6,000. The £6,000 not accounted for by that increase could be met by borrowing from the rates, but he hoped that would not be necessary, as the Gas Undertaking had built up a certain reserve.

Sir Clifford pointed out that whereas they were proposing an increase of 6d. per 1,000 cu.ft., recent increases in London averaged 1s. per thousand. The price of gas for power purposes would be increased from 2s. 2d. to 2s. 8d. per 1,000 cu.ft. The cost of gas through automatic meters would be the same as that supplied by the Plymouth and Stonehouse Gas Light and Coke Company, when the number of cubic feet per penny was reduced from twenty-six to twenty-two, inclusive of meter rent and fittings.

The Gas Committee's proposals bringing the new prices into effect from the beginning of next quarter were approved.

The 28th Annual General Meeting of
The British Commercial Gas Association

The 28th Annual General Meeting of the British Commercial Gas Association was held at Gas Industry House on Wednesday, Dec. 13, the retiring President (Mr. A. M. PADDON, M.Inst.C.E.) presiding.

Opening the proceedings, the PRESIDENT said the first matter to which he would refer was his relinquishment of the office of President. They would have been relieved of his Presidency a year ago, but acting on the best available advice he accepted a further term of office. He would like to refer to the uniform kindness and consideration which had been extended to him, without which he would have had to relinquish office sooner than he had. Mr. Paddon went on to speak of the great pleasure it had been to have the Association as guests at Brighton, and he hoped they were able to afford the members a certain measure of interest and entertainment. Brighton was, however, a pleasure resort, while the first principle of their Association was concerned with commerce and industrial interests. For that reason they were unable to offer the members a full measure of these interests at Brighton. Their new President, however, came from one of the leading industrial towns, and what they could not learn in Leicester they would not acquire anywhere else.

The accounts for the year ended March 31, 1939, as circulated to all members, were introduced by Mr. W. J. SANDEMAN (Croydon), the Hon. Treasurer, and were formally approved on the proposition of the PRESIDENT, seconded by Col. W. M. CARR.

The Annual Report

Introducing the Annual Report, which had also been circulated to members, the PRESIDENT observed that this reflected a great deal of useful work as well as some consolidation of the Association's position. After outlining the Association's various activities during the year under review, the report touched upon the general difficulties occasioned by the war, said Mr. Paddon. While some undertakings had not yet been very seriously affected by present conditions, others were suffering from the precarious nature of their coal supplies. There were still further problems in front of them, among which labour considerations must be faced. Indeed, they must expect some considerable accentuation of the difficulties which they were already beginning to encounter. All of these would seriously tax the resources at their disposal. The PRESIDENT then formally moved the adoption of the report, which was seconded by Mr. A. W. SMITH (Birmingham), and a short discussion followed.

Mr. G. LE B. DIAMOND (Folkestone) enquired why the Association had not done more "prestige' advertising, on the lines of that adopted by the electrical industry.

Mr. H. D. MADDEN (Cardiff), Chairman of the Executive Committee, in reply, stated that this question had not been lost sight of; they had discussed it very closely and felt very strongly that this should be continued on the lines of a national statement on the services the Gas Industry was rendering to the nation. They had earmarked a sum of money to be used for this purpose in the near future, and Mr. Sandeman had suggested that such publicity should include a national poster also dealing with this theme for display throughout the country.

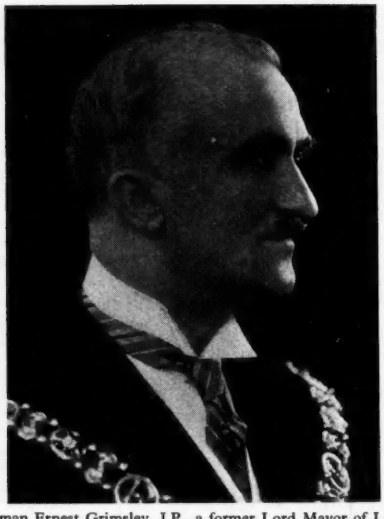
Discussion Groups

Mr. G. E. CURRIER (Bradford) made a plea for the continuation of the Salesmen's Discussion Groups. They were fully aware of the difficulties of holding such meetings, with curtailed transport facilities and the blackout; but it was most essential that the Industry's contact staff with the public should continue to meet to discuss and decide upon the most effective means of rendering useful service to their consumers. Salesmen and saleswomen were the "ambassadors at large" of the Industry, and nothing would do more to maintain goodwill than for the consumer to feel that "the man from the Gas Company" was always ready to assist, and assist usefully, with their war-time problems. Further, Mr. Currier continued, gas undertakings would be well advised to take the opportunity seriously to consider the reorganization of the commercial departments, and hoped the Association would continue to offer this service. He could speak from his own experience as to the value of it.

Mr. W. D. ROWE (Manager of the B.C.G.A.) said that they were in touch with the Salesmen's Circles in regard to the continuation of the Discussion Groups, and the various district organizations were going very carefully into the matter. They were hopeful that a number of Discussion Groups would be restarted shortly. Replying to Mr. Currier's other question, Mr. Rowe said that Mr. Gaskin's services were still available to undertakings.

The PRESIDENT observed that advertising methods must necessarily vary in different circumstances. Many original poster spaces had been pasted over, and there was a feeling that the public were not so open to the reception of information as they were. In London, for instance, where extensive evacuation had taken place, their policy would have to be governed by factors which did not exist in reception areas. He recalled that after the last war gas acquired an extraordinary prestige which it did not enjoy before. Gas was brought into prominence, and the industrial side took on an impetus which it certainly did not have previously. Something of the same kind might well happen now.

The New President



Alderman Ernest Grimsley, J.P., a former Lord Mayor of Leicester, who has been elected President of the British Commercial Gas Association for the coming year, is a son of the late Mr. Francis Grimsley, of Leicester. He was born on Jan. 19, 1875, and at the age of 14 was apprenticed to the printing trade, with which he has been connected ever since.

In 1894 he joined the Typographical Society, and in 1914 he became President of the Leicester branch, which he has represented at numerous national gatherings of printers. Since July, 1928, he has held the position of Secretary to the Leicester branch of the Society. He is also a member of the local Printing and Kindred Trades' Federation. He has always been a staunch and active member of his party, and was first returned to the City Council in November, 1919. He was elevated to the aldermanic bench in November, 1928.

Alderman Grimsley has devoted the past forty years of his life to public work, taking a special interest in educational matters and the moral welfare of young people. As Chairman of the Evening Institutes Committee he has always advocated continuation classes and full use of the facilities afforded by the local School of Technology.

Alderman Grimsley has been a member of the Leicester Gas Committee during the whole of his civic life, and acted as Vice-Chairman from 1928 to 1936, when he was appointed Chairman of that important Committee. As Lord Mayor of Leicester in 1934-35 his year of office was a memorable one, including the celebrations of the Silver Jubilee of King George V. and Queen Mary, the third extension of the City's boundaries, and the opening of the Municipal Aerodrome.

In the midst of his busy life, Alderman Grimsley takes pleasure in being a student of nature subjects, especially entomology, and is also interested in art and music. He is fond of gardening, and a keen reader of Dickens and books of travel, including those on Tibet, China and Japan.

Need for Prestige Publicity

Col. W. M. CARR drew attention to the electrical propaganda which they had lately encountered. They had been advised of the truce which was supposed to have been called to competition, but they in the north found it difficult to realize that such a truce did exist on the electrical side. Recent electrical propaganda, which

he supposed was instigated by the E.D.A., had drawn attention to the service rendered to the nation by the electrical industry, and it was desirable that the Gas Industry should have equal publicity.

Mr. A. W. SMITH said that the two industries were represented by a joint committee in regard to rationing. They had agreed in general terms to this truce, but when it came down to deciding what those terms involved it was a very different matter. He believed that the recent advertising to which Colonel Carr had referred did not have the general approval of the electrical industry. The Gas Industry, for its part, was endeavouring not to put out any advertising which was not in conformity with the spirit of the truce—and it might be that the electrical side were not quite playing the game in this respect.

Mr. H. D. MADDEN assured the members that the advertising they had in mind would be of the national prestige type and would be very carefully worded.

The resolution for the adoption of the annual report was then put to the meeting and carried unanimously.

The New President

The PRESIDENT proposed that Alderman Ernest Grimsley, J.P. (Chairman of the Leicester Corporation Gas Committee), be elected as his successor in the Presidential chair. There could not, he said, be a better selection than Alderman Grimsley at the present time. In him they had one who was closely associated with the more active interests of the Industry. At Leicester they had an industrial and commercial centre which was operating to an extent which few others could. This, coupled with an individuality such as Alderman Grimsley possessed, made his choice a very fortunate one. In him they had the benefits of a long life in the Industry, while he had a catholic range of interests which embraced every form of social and commercial activity.

Mr. H. D. MADDEN, seconding the resolution, remarked that they had as President of the Association sometimes the Chairman of a gas company and sometimes the Chairman of a gas committee. It was all to the good of the Industry and their publicity work to have the office thus divided between companies and corporations, and he was sure that in this instance of Leicester, which was an honoured name in the Industry, they had made a worthy selection.

The resolution was cordially accepted, and in acknowledging his election Alderman GRIMSLEY thanked the members for their confidence in him, which he trusted would not be misplaced. He realized that in undertaking this office he did not bring to it any great intelligence; but he did bring to it sincerity for the progress of the Industry, which was unchallenged. Alderman Grimsley went on to say that he had given a fair share of his civic activities to the work of the Gas Committee, and instead of changing about from one committee to another as many did he had always concentrated his interests on this one Committee ever since he had been on the Council.

The Association's Auditors (Messrs. Cash, Stone & Company) were re-elected on the proposition of the PRESIDENT, seconded by Mr. G. E. CURRIER.

Vote of Thanks

Alderman GRIMSLEY proposed a hearty vote of thanks to the retiring President for the services he had rendered during his period of office. They all remembered with considerable pleasure their visit to Brighton and Mr. Paddon's connexion with the Industry there. Mr. Paddon had given many years of service to the Gas Industry, and he had added to that service by his Presidency of the B.C.G.A. The Industry owed him a debt of gratitude, and in relinquishing his office he could feel that he had rendered a service which was genuinely appreciated by all with whom he had come into contact.

Major F. J. BYWATER (South Metropolitan Gas Company) seconded the vote of thanks and at the same time offered his felicitations and congratulations to the new President and wished him the best of luck in his year of office. It gave him the greatest pleasure to second this vote because he had probably—with two exceptions in that room—more knowledge than anyone of the value of Mr. Paddon's services to the Industry, as he had the honour of meeting him every week and appreciating the great interest he took in the Industry, his depth of mind, his knowledge, and the experience which he brought to bear on all its problems. His period of office had been one which they had all admired intensely, and they thanked him most sincerely for the time he had given and for the way he had conducted their meeting at Brighton.

Mr. A. W. SMITH said he would like to support the vote of thanks as he was Chairman of the Executive Committee when it was decided to ask Mr. Paddon to accept the Presidency. In spite of his reluctance to take the office, they were determined that he should become their President, and he could assure him that he had made a tremendous number of friends in the Industry.

The PRESIDENT briefly acknowledged the vote, and the proceedings terminated.

Re-conditioning of Oil-containing Vessels

By KENNETH S. LOW

THE cleansing of vessels and appliances which have contained viscous, glutinous, or film-forming materials usually involves considerable expenditure of time and unproductive labour if they are to be maintained in a serviceable and efficient state.

A novel appliance has lately been evolved which would appear to have very extensive applications in de-greasing, gas freeing, and film removal by solvent action in relation to such vessels as oil containers, bunkers, tank cars, and barges used in the transport and storage of chemicals and other substances chiefly of a hydrocarbon nature, such as tar, asphalt, bitumen and heavy oils. It is also applicable to the cleaning and conditioning of pipe-lines, coils, jets, valves, oil-immersed pumps and electric transformers.

The necessary apparatus for operation of such process forms the subject matter of recent patent applications and is known as the "Dezolvator." Tests and demonstrations which have recently been carried out in this country have provided some remarkable figures showing that treatments which would otherwise have taken two days to complete, have been effected to a considerably more efficient degree in a matter of minutes, or less than half an hour.

The apparatus, which is compact and mobile, consists essentially of a pressure vessel having a capacity of about 70 gallons. It is fitted internally with heating coils which may be connected to any steam or other heating supply. The vessel is divided in an annular manner so that its two compartments may be filled with similar or dissimilar solvents and other materials as desired. By means of the heated coils, pressure is generated in the "Dezolvator," whereupon solvent substances are vapourized and may be controlled and led by suitable valves and pipe-line to the vessel under treatment. Owing to a substantial pressure in the "Dezolvator" and a relatively low pressure (atmospheric) within the tank or other appliance being cleaned, the solvent is directed with great velocity to all sides, and thus penetrates deposits on the walls, seams, and fittings where it will condense and thus free the surfaces from oily and like matter. In cases where deposits are thick, hard, or oxidized, the process may have to be repeated, but as each operation is in the nature of a "shot," the total time involved is very small. The resultant sludge may be subsequently drawn off, and if desirable, filtered through cloth, whereupon the re-claimed solvents may be used again. The solvents or mixtures of materials used in the "Dezolvator" will vary to some extent with the individual problem, but in no case need there be the slightest deleterious effect upon metallic surfaces, because no corrosive liquors are used.

The apparatus is of simple construction without any complex parts to maintain; no mechanical equipment other than a steam supply is required, while labour for operation is negligible. Further, as no steaming or preliminary treatment of vessels is necessary, local stresses or damage which might be caused by heat or mechanical methods are avoided.

In the course of a test witnessed by the writer in the presence of departmental officials, a 14-ton tank car in very bad condition, having been in use over a period for tar, was effectively cleaned by this method in 20 minutes, the metallic surface being restored to virtually unused state. It was gathered that an indifferent approach to such condition by ordinary methods required two days' labour. Only 8 gallons of solvent were used in this demonstration, the actual loss being 2 gallons, 6 being reclaimable for further use. In view of the striking results demonstrated and at such obviously low cost, the advantages offered by this novel appliance which can be made available either as a service or otherwise as arranged, should prove of the greatest significance to the oil, gas, chemical, engineering, paint and transport industries.

It is understood that the company which is operating the first mobile unit in this country is prepared to afford facilities for demonstration to those who have to deal with the problems indicated. Interest already aroused would appear to be considerable, and in numerous directions.

Use of Gas as a Fuel for Motor Vehicles

Discussion at a Meeting of the Institution of Automobile Engineers on Dec. 12 of a Paper by Dr. J. S. Clarke, of the Birmingham Gas Department, presented to the North Eastern Branch of the Institution last January and published in the November issue of the Institution's Journal.

Introducing the Paper, Dr. Clarke said that since it was presented there has been a change in the wall thickness of vehicle cylinders, which is now 0.24 in., and the life of these has been extended from 5 to 6 years. He mentioned that on Nov. 8 the Minister of Mines announced a concession of tax on the unladen weight of the vehicle to exclude the gas equipment. This applies to producer gas driven vehicles as well as to compressed gas.

Continuing, Dr. Clarke said:

Compressors are the essential mechanism in the compressed gas system, and a great deal of research work has been expended, both in this country and abroad, on the development of suitable machines. For compression to 5,000 lb. per sq.in. 4 or 6 stages may be employed, with the necessary intercoolers and drains between each stage. Although the initial capital cost is lower for a four-stage compressor than a six-stage, the former absorbs about 35% more power.

Owing to economic considerations, compressors with an output of 80 or 100 cu.ft. per min. of free gas will probably become standardized for large-scale refuelling stations, and possibly smaller and cheaper machines, having a maximum delivery pressure of 3,000 lb. per sq.in., will be installed by comparatively small garages and fleet owners.

In the design of a gas refuelling station, the size or number of compressors is clearly a function of the number of vehicles to be supplied; moreover, it is governed by the amount of storage reservoirs which are provided. Experience has shown that the ideal station should have a storage capacity eight times the hourly rating of the compressor.

To obtain the maximum transfer of gas from the storage system, it is usual to divide it into two or three groups of cylinders. The ratio adopted in Birmingham is 20%, 30%, and 50%.

The change-over is made by hand-operated valves, a process which tends to increase the time required for filling. On the Continent, this system has also been adopted, but an improved method of operating the valves has been developed; the valves, two or three in number, are grouped together and worked by a camshaft, the charging station attendant merely moving one lever. I am pleased to say that a combination of valves of this design will soon be on the market in this country.

For rapid filling it is not only necessary to have an adequate storage at high pressure, but also to have a quick fastening on the charging pipe. Two designs are now being made and tested in Birmingham, by which it is anticipated that the attachment of the pipe to the charging valve will take five seconds. From a recent observation the time required to charge a seven cylinder vehicle, having a total water capacity of 10.69 cu.ft. from atmospheric pressure to 3,000 lb. per sq.in. was 4 min. 15 sec.

The only practical way of measuring the amount of gas transferred to a vehicle is by recording the increase of pressure registered by the pressure gauge situated on the vehicle itself. This gauge is automatically checked by the one on the filling station.

Application of Gas to the Self-Ignition Engine

Recent experiments on a single cylinder Tangye engine with direct injection combustion chamber have shown that a high brake mean effective pressure can be maintained with accompanying high thermal efficiency, using a minimum quantity of oil, the remaining part of charge being town gas, without unduly high maximum pressures being developed.

Details of engine: 4½ in. bore, 5¼ in. stroke, compression ratio 15·76/1.

The engine was set to run light at 1,000 r.p.m., and the oil delivery was cut down on the fuel pump until the speed of 1,000 r.p.m. was barely maintained. Town gas was then introduced into the air stream, and the engine immediately responded to the increase in calorific value of the mixture, the quantity of gas was adjusted to suit the load, amount of oil remaining constant. P.T. diagrams were taken by an electronic indicator.

TEST RESULTS.

Fuel: Town Gas—Oil.

Brake m.e.p. lb. per sq. in.	B.Th.U. per B.H.P. Hr. input. Oil	Gas.	% B.Th.U. input as Oil.	Brake Thermal efficiency. %	% CO_2 in Exhaust.	Maximum Explosion Pressure. lb. per sq. in.
80·3	1,912	6,640	22·3	29·8	7·3	600
61·1	2,610	6,840	27·6	27·0	5·6	370
42·9	3,720	8,210	31·1	21·3	4·2	370
27·2	5,850	10,320	36·2	15·75	3·4	340
		Oil Only.				
80·3	8,422	—	—	30·2	7·3	660

It may be concluded that compressed gas can be successfully applied to the compression ignition oil engine.

Example of a Possible Lay-out of Typical Compressed Gas Storage Station

The vehicles are assumed to be similarly equipped with six traction cylinders, each with a capacity of 1·76 cu.ft., being charged to a pressure of 3,000 lb. per sq.in. The maximum storage capacity of each vehicle, corrected to 60° F. and atmospheric pressure, is 2,155 cu.ft. gas. With an assumed gas consumption of 25 cu.ft. per mile, the mileage of each vehicle per charge would be 86.

In this example the filling station is taken as comprising 18 storage bottles, each of 19 cu.ft. water capacity, having a free gas capacity of 6,300 cu.ft. at 5,000 lb. per sq.in., and ensuring a total storage for the station of 113,400 cu.ft. This would be supplied by the employment of two compressors having capacities of 100 cu.ft. free gas per minute to a final pressure of 5,000 lb. per sq.in.

The time required to charge the empty storage station would be 9½ hours, and this would be reduced for subsequent replenishments as the system would not normally be completely empty.

For the purpose of this example, the 18 storage bottles are divided into units of ten, five, and three bottles connected in parallel.

Number of charges per day = 76.

Total gas consumption = 160,500 cu.ft.
= 10,030 cu.ft. compressor hour.

Charging could be taken, conservatively, as 6 minutes per two vehicles if there were two charging panels.

∴ Charging time per 38 vehicles would take 1 hour 54 minutes.

Economic Considerations of Gas Refuelling Station Based on Requirements of Example

CAPITAL OUTLAY.

(a) Compressors: three required (one to act as standby) complete with electric motor, starter, instruments and pressure gauges, erected on prepared foundations, £1,750 each	£5,250
(b) Debenzolizing plant (installation of this is optional and may not be required)	800
(c) 18 storage cylinders, each 19 cu.ft. capacity, complete with fittings and installed	3,500
(d) Control panel, isolating valves, 2-point charging auto-control valve, and charging hose ..	220
(e) Heat exchanger for dissipating heat from compressor cooling water (750 gallons per hour for each compressor). Open tank on roof of building or radiator suggested	120

(f) Compressor buildings and office, preparation of site, and steel framework for cylinders ..	1,700
	£11,590

ANNUAL CHARGES.

(i) *Capital.*	
Interest at 5% on capital	£574.5
Depreciation of (a) at 10%	525
Spares and repairs, excluding labour (a)+(d)	100
Depreciation (c) 10%	350
Depreciation and maintenance (b)+(c) at 10%	92
Maintenance and repairs of building	50
	£1,691.5
(ii) *Operating Costs.*	
Compressor hours per day—28.	
Compressor hours per year—7,700.	
Electricity consumption 8.5 K.W. hours/1,000 cu.ft. delivered = 392,000 K.W. hours.	
Cost at 0.55d. per unit	£900
Oil, waste, lighting, and heating building ..	150
Labour Charges.	
Two men, 50 hours per week at 1s. 5d. per hour, annual wages	£360
Two men, half time at 1s. 5d. per hour, annual wages	180
One fitter for maintenance (part time) ..	100
50% overheads on wages	320
Total annual charge	£3,701
Gas compressed per annum	46,200,000 cu.ft.
Cost of compression per 1,000 cu.ft. = $\frac{3,701 \times 240}{46,200}$ =	19.25d.
Assuming 300 cu.ft. of gas C.V. of 475 B.Th.U. per cu.ft.	= 1 gallon petrol
Then cost of compression per equivalent gallon	= 5.77d.
Cost of gas per equivalent gallon, if price is 5d. per therm at inlet of compressor ..	= 7.30d.
Total cost per equivalent gallon	= 13.07d.

The compression costs depend on several factors which can be controlled and probably reduced compared with the figures given in the example. Capital charges are high, but I am confident that manufacturers of equipment will co-operate with us to reduce these as the development of compressed gas takes place.

The cost per equivalent gallon for high calorific value gases will be reduced in inversion proportion to the calorific value.

Compressed gas is a practical fuel for motor vehicles, and it will do its job without any inconvenience. It is a new industry, and it needs capital and Government support.

DISCUSSION.

Lord **Strabolgi** said it was obvious to everyone that, as Dr. Clarke had remarked at the end of his Paper, this was a new industry and as such needed capital and Government support. He understood we had plenty of petrol in the country, but if the war continued for a long time all sorts of things might happen and that condition might not continue. The more they could use alternative fuels the better it would be for the finances of the country. To what extent was it possible to use coal gas for this purpose and in the manner that Dr. Clarke had described? What would be involved in replacing 500 million gallons by the use of coal gas. What would be involved in the way of plant and equipment and pressure on the coal mining industry and so on? It seemed to him that the effect of the policy that had been suggested would be enormous. In all these discussions everyone turned to the Government. He enquired what would be the cost of conversion.

Dr. **Clarke**: £120.

Lord **Strabolgi's** next point was whether the system was suitable for ordinary cars, doctors' cars for example, delivery vans, &c., or whether it was only for heavy lorries. He had not gained a clear idea as to the running costs, taking into account the relief from petrol duty which had been granted for five years, but he understood it was something of the order of 13.07d. per equivalent gallon of petrol. The capital cost of a filling station had been given in round figures as £11,600. How many of these would be needed? He had been looking into the question from another angle, and it seemed to him that at least £250,000 would need to be spent on filling stations on the arterial roads to make this a practical proposition. Another proposal he had heard discussed was that the gas undertakings all over the country should be induced to provide the filling stations to use their own gas, compressors, reducing valves, and other equipment. The whole matter was very well worth pursuing.

Wing Commander **Cave Brown Cave** said the alternative method of using a gas producer carried on the vehicle was well worth consideration, but he did not think it would ultimately persist because for one fundamental reason the calorific value of the producer gas/air mixture introduced into the cylinder was so much lower than that of gas or petrol. As a convenient expedient that could be adopted now, however, the producer was well worth consideration, and he was sorry the Author had not given more modern information about the producer gas vehicle. The problem of compressing gas involved a great many difficulties. He could not understand why it was necessary to compress up to 5,000 or 6,000 lb. per sq.in. in order to get it into the cylinders at 3,000 lb. Where capital cost was so important the question of what pressure they ought to compress to in order to charge the vehicles reasonably quickly needed careful consideration.

Compression Ratio

As regards the engine itself, he thought the Paper gave a good deal too much weight to what could be done with a petrol engine converted to use gas at atmospheric pressure. It was well known that compression ratios of 16:1 could be used, and if Dr. Clarke based his estimates on ratios of 6:1 he was being hopelessly pessimistic and was certain to get results out of all reason. He must know that compression ratios of 16:1 could be used, and that was a development which needed pressing on promptly. There were two ways of working with those ratios and they both wanted consideration. One was to use the normal compression-ignition engine drawing in a considerable proportion of gas with the air and then igniting the charge with a small quantity of oil. That was a very interesting system indeed. The other was to use a 16:1 ratio engine with spark ignition. Such a system had considerable advantages in that the engine was likely to be cleaner than a compression-ignition engine, and the gas mixer, magneto, and sparking plugs would cost less. He suggested that Dr. Clarke might do very valuable work in sorting out those two alternatives; the oil-ignited compression-ignition engine using a large proportion of fuel in the form of gas, and the spark-ignited engine with a 16:1 ratio using the gas normally aspirated.

A further important point was to determine how fast the engine could be run. If the maximum pressure was a limiting factor it could be offset to a considerable extent by running the engine at a higher speed. Methane was almost an ideal fuel and there were great possibilities in it. The idea of using methane for transport purposes seemed extraordinarily attractive. He believed Birmingham had worked it out that the amount of methane obtainable from its sewage gas was about enough to run the whole of its own motor transport.

Mr. **Scott** (Cadbury Bros.) said the conversion of his Company's vehicles to compressed gas had been a complete success. A 2½-ton Commer delivery van had so far done 1,200 miles without any troubles. The running costs were lower than on petrol at present prices, and they had been so pleased with the first van that they now had another five under way. There had been no difficulty in starting up or doing what they liked with the van. They had found that the gas had a certain drying effect on the pistons and rings and they had introduced a little upper cylinder lubricant. The weight of the equipment was about 8 cwt.

The Erren Cycle

Colonel **W. M. Carr,** in a written contribution read by Mr. P. C. Pope, said that during the past two years the United Kingdom Gas Corporation, Ltd., had actively collaborated with leading engine manufacturers with a view to developing the use of coal gas as an efficient fuel for internal combustion engines. The author had pointed out that the development of the high-speed compression-ignition oil engine, and positive pressure supercharged engine, directed attention to the possibility of similar developments in the gas engine. In this connexion he (Colonel Carr) became interested in the work carried out by the Erren Engineering Co., Ltd., in the application of the Erren cycle as a simple means of applying the positive pressure principles. The Erren valve was originally designed for, and was supplied to, a hydrogen engine, but was equally applicable to a coal gas engine.

On the liquidation of the Erren Engineering Company, the patents were purchased jointly by the National Gas & Oil Engine Co., Ltd., and the United Kingdom Gas Corporation, Ltd., and during the past 18 months considerable further experimental work had been carried out as a result of which the Erren cycle had been applied to small stationary engines and traction engines with complete success. Development on the application of this system to high-speed traction engines had been directed along two lines: (a) To normal compression ratio petrol engines, and (b) to high compression ratio Diesel oil engines. A six-cylinder A.E.C. petrol transport engine (5 to 1 compression ratio) converted to the Erren

gas system, without alteration to the compression ratio, showed a 16% improvement in power performance on town gas of 500 B.Th.U. as compared with petrol.

Tests carried out with the same engine using the standard type of normal induction gas/air mixer showed an 18% reduction in power performance as against petrol, which confirmed the Author's statement with regard to this latter type of conversion. Experiments on the application of the Erren patent to Diesel-designed traction engines had shown that efficiencies at least equal to those obtained when using fuel oil could be obtained by a simple inexpensive conversion of the standard engine. On stationary Diesel engines converted to town gas, figures of 6,700 B.Th.U. per b.h.p./hour had been maintained on variable loads.

Colonel Carr added that he had hoped to be in a position to give road performance figures as the result of road tests now in progress by his Company's subsidiary, Gas Power Conversions, Ltd. These would be available in the course of a few days and he would then submit a further written contribution to the discussion on the Paper. Under war-time conditions he suggested that, given the full support of the Government, it was a national duty to develop the use of all home-produced fuels, and from his own experience he was satisfied that the use of town gas in modern internal combustion engines would also prove an economic peace-time proposition. There could be no doubt that, given the necessary priority of manufacture to enable free development of the commercial application of town gas to internal combustion traction engines, the Gas Industry could perform a useful national service in war-time by conserving liquid fuels for the use of His Majesty's Forces, and at the same time develop for peace time the use of the country's natural fuel resources in its most efficient form.

Mr. **Pope,** having presented Colonel Carr's communication, replied to Lord Strabolgi's question about the effect of using gas for transport upon the coal mining industry by stating that on the basis of Dr. Clarke's calculation of 300 cu.ft. as the equivalent of one gallon of petrol, the displacement of 500 million gallons of petrol would necessitate the carbonization of an additional 10 million tons of coal per annum.

A Very Large Margin

Mr. **J. S. Blair** (Stewarts and Lloyds, Ltd.) said he shared with Wing Commander Cave Brown Cave the feeling that compression to 5,000 lb. per sq. in. for the use of gas at 3,000 lb. per sq. in. represented a very large margin. How many cu.ft. of gas were equivalent to one gallon of petrol? Three different figures had been given by the author. One, in relation to a 20 h.p. Austin van using 24 cu.ft. per mile, worked out at 480 if one assumed the vehicle did 20 miles per gallon; another was given as 250 and a third as 300. A fundamental difference as he saw it between the petrol and the gas vehicle was that in the case of the gas vehicle one carried around a great deal of unnecessary weight. The great advantage of petrol was that it was a very highly concentrated fuel. Roughly speaking, the weight of petrol plus the weight of the tank was 10-12 lb. per gallon, whereas the corresponding figure for gas equipment was 180 lb. per equivalent gallon. For some years the tendency had been to reduce the weight of vehicles, and from that angle the use of gas was a retrograde step, the equipment amounting to about 25% of the weight of the vehicle. Another objection was the bulk taken up by the cylinders. With gas a vehicle would do about 87 miles between filling, whereas the majority of cars could do 200-300 miles on petrol. The weight and bulk considerations seemed to him to be the chief objections. The question of where to store the cylinder in a private car was also a problem. Cylinders were by no means small, and their effect would probably be to reduce a four-seater to a two-seater. If all vehicles were converted for gas, where would be the money to pay for all the other things the country needed? In considering the merits of gas the comparison should not be between petrol and gas but between gas and other alternatives to petrol. Producer gas had already been mentioned, and another possibility was electricity. If they were going to equip a number of filling stations with compressors and all the extra things required for filling vehicles with gas it was a question whether it would not be more economical to use the gas in some central electricity station and charge the vehicles with electricity. The extra weight of accumulators was possibly no greater than gas cylinders.

From where was the gas coming that was to be used at the filling stations? Was it to be delivered by high pressure lorries or were they all to be situated near gas companies' premises, or was the gas to be piped to the filling stations? He did not think that had been taken into account in estimating £11,000 for the equipment of a filling station. If the gas had a fair amount of H_2S, such as coke oven gas, he took it that it would be necessary to clean the gas before using it in the engine.

Mr. **T. D. Walshaw** (the National Gas & Oil Engine Co., Ltd.) said it had been his good fortune to carry out tests on ordinary gas engines and high compression engines using gas as a fuel. Taking what he called a normal gas engine of 6:1 compression ratio, the maximum brake thermal efficiency was about 30% and the maximum mean effective pressure was about 60 lb. Supposing the compression ratio was increased to 15:1 the engine would develop a maximum m.e.p. of between 100 and 110 lb. per sq.in. At that pressure one would get a brake thermal efficiency of 36.5%, or about 18% more than at 6:1 compression. If the gas was ignited by the oil spray it would be found that although the m.e.p. remained about 100 lb. the brake thermal efficiency would show a substantial rise. Taking the gas injection engine using either method of ignition one got a super-charging effect and the m.e.p. would be 120 lb. per sq.in. and it could be improved with a little further development. The figures for an oil engine were almost identical, giving a brake thermal efficiency of 32% and an m.e.p. of 95 to 100 lb. per sq.in. Dr. Clarke had not mentioned that when they were using oil ignition of gas in the engine they got a double delay—first a delay due to the oil being ignited by compression and secondly a delay due to the gas being ignited by the oil. That, in his view, explained why the final pressure rise was so high. "It does seem to me," added Mr. Walshaw, "that it is a terrible criticism of the society in which we live that there has to be a war before a development of the magnitude now before us is properly advocated."

Captain **W. P. Rogers** (Cardington) said there was not at present much likelihood of a very large increase in the use of gas, but the occasion might arise when it would become very urgent, and somebody should at least have a skeleton scheme in readiness to put into operation.

Supply of Bottles

Mr. **Pilkington** (Lancashire Associated Collieries) said the question of the supply of the bottles was very important. They could not expect garages to spend £11,000 on compressors and plant unless they could be assured of supplies of bottles. It would be an advantage if the bottles could be made detachable from the vehicle, but he believed that at present the law was that they must be rigidly attached. Filling of cylinders at the gas-works would do away with distribution costs, whereas if compressors were put down at garages there would inevitably be some cost of distribution. With regard to the weight of cylinders there was a French cylinder wound with piano wire, weighing much less than the usual type of cylinder, but for some reason the Government had not approved of it.

Mr. **Marsh** (Chesterfield Tube Co., Ltd.) remarked that the figure of £11,000 quoted in the Paper was for a very large compressing plant. For his own Company's station, with two compressors, he did not think the capital cost was much more than £1,500, and it was sufficient to run their own seven vehicles, and they could have run more if the vehicles had been available. Standardization of fittings was extremely important.

Mr. **G. Gerard Wilson** (Whitwood Chemical Company, Ltd.) said his Company had been running two Leyland vehicles on compressed coal gas for over five years. They were originally petrol engined vehicles with compression ratios of 5:1 and they were still equipped for running on petrol because very often they had to do journeys of 120 to 150 miles and the operating range for gas was only a matter of 60 miles. The vehicles had run from 160,000 to 170,000 miles, half of which had probably been done on gas and they had been absolutely trouble-free as regards gas traction, and so far as they could see there were no technical difficulties whatever. The radius of action was from 50 to 60 miles and they estimated that about 250 cu.ft. of gas was equivalent to a gallon of petrol. Their compressor was a four-stage single crank machine made by Peter Brotherhood capable of compressing 5,000 cu.ft. per hour to 5,000 lb. per sq.in. The capital cost of the compressing station, with gas driven power, using a horizontal gas engine, and one storage bottle of 15 cu.ft. capacity including the building, was about £1,350. On the question of driving compressors, he could not understand why they always referred to electrical drive, when gas was available, often at a much cheaper rate.

Basic Petrol Ration Withdrawn

Reference had been made by Dr. Clarke to the various restrictions which tended to retard this development, and, as many others had said, it was appalling that it was necessary to have a national calamity to awaken interest in this matter and to get those restrictions either altered or removed. They all welcomed the Government's action in amending the regulations regarding the unladen weight of vehicles and taxation. It came as a big shock to him ten days ago to be informed by the Group Organizer that the basic petrol ration for their two Leyland vehicles had been withdrawn. On enquiry of various officials they were informed by the District Traffic Officer that he was acting on instructions from headquarters in London, and that any vehicle equipped for gas propulsion was not to be entitled to a basic ration for petrol, but that the owners could apply for a supplementary supply. That action was subsequently confirmed by a report from the Institute of British Launderers. It was apparently the considered

opinion of the Ministry of Transport that these basic rations should be withdrawn. The result so far as he was concerned was that he had cancelled orders for the equipment of eight or ten other vehicles for gas propulsion. He believed that Wallasey had also held up three similar orders until the basic ration was restored, so that it was evident that such action was tending to retard the development of gas traction. He had written to the Minister and asked whether this regulation applied to any vehicle adapted for gas traction, whether by gas in bags, producer gas, &c., but so far he had not received a reply. He suggested that some kind of organization should be set up to take in hand the development of gas traction.

Dr. **C. M. Walter** said they had been working in Birmingham very hard on these problems behind the scenes by day and night, because they had a great deal of hard work to do, particularly during the last two years when things became very interesting in view of the very high efficiencies they found they could get. He had over 40 applications for vehicles in hand at the present time, and their problem was to make sure that they could get on with the job. A lot of the work described by Dr. Clarke was new to him as the figures were obtained only during the last few days. They felt they were getting wonderful results and they could claim that they had got something that was economical and practical, and they must get the job going as quickly as they could.

The Author's Reply

Dr. **Clarke,** in his reply to the discussion, remarked that Lord Strabolgi had asked what was their policy, and one or two had suggested that they and the producer gas people were on opposite sides of the fence. Nothing of the sort. If he were to define a policy it would be that vehicles operating under local conditions not exceeding a certain radius, and probably excluding vehicles above a certain weight, should all be made to run on gas. That was a very bold policy with a great deal behind it.

The cost of converting a vehicle was roughly £120 for a six-cylinder job, and he was quite certain that that figure was going to be reduced considerably. The question of running costs had been answered by another speaker, but he thought they could take it that there was a saving of gas per vehicle mile run at the present time, bearing in mind that gas was costing 5d. per therm at the inlet connexion. Compression costs were of the order he had indicated in the Paper and the capital charges on the vehicle, which were not inconsiderable, were being written off in six years instead of five. He saw no reason whatever why with careful management the balance in favour of gas should not be further improved. The Home Office Inspector had been very kind in regard to taking cylinders annually for test to destruction to enable him to form a policy, and the Birmingham Gas Department had sanctioned the taking of a vehicle out of service every year for that purpose. They had always had cylinders available, because their stock of cylinders was of the order of 60, and they had had vehicles running since 1931. In reply to Wing Commander Cave Brown Cave's question regarding the necessity for compression to 5,000 lb. per sq. in., a simple mathematical calculation would show that it was desirable to maintain that figure. Mr. Scott had spoken as an operator, and he thought the fact that a firm like Cadburys had adopted gas for traction showed that there was something in it. With regard to Mr. Blair's question about the equivalent of a gallon of petrol, the Austin van mentioned in the Paper was doing only 12 miles per gallon before conversion to gas, on local delivery work, and the calculation of 480 cu.ft. was, therefore, wide of the mark. Reference had been made to the weight of the cylinders, and someone had mentioned 7 to 8 cwt. for a private car, but with equipment of such weight the car could do about 300 miles between charging. There was a certain car which, with equipment weighing 3 cwt., could do 120 miles per charge, and it was a magnificent job on which the firm concerned was to be congratulated.

With regard to electric accumulators, the weight of the necessary equipment for the same amount of energy stored would be about eight times the weight of the equipment for compressed gas. The question of H_2S was a serious point but there was not any in town gas and, therefore, the point did not arise on the present Paper. He congratulated Mr. Walshaw on his contribution to the discussion and said he would study his figures with interest and deal with them in writing. Mr. Roger had said it was not immediately necessary to find an alternative fuel, but it might be in the future. They could not go to the compressor makers and get delivery next week. It was going to take nearly six months; hence the urgency of getting the matter going on a big scale. He believed someone had suggested an expenditure of a quarter of a million on filling station equipment; his answer to that was that they had had one million in mind for a long time. Mr. Pilkington was perfectly justified in his remarks about it being possible to get cylinders and attach them to the vehicle in the charged condition. He had been told that in Italy buses were actually operating on the public services in the cities, and crates of cylinders were transferred to the buses while in service. The crates of bottles were taken to the termini, where quick connexions were made. He did not feel too enthusiastic about that idea. In Germany and France there were large 10-ton lorries with cylinders, and on certain routes in Berlin the buses were operating on compressed gas obtained in that manner. He agreed with Mr. Marsh that the fittings should be standardized. He could not understand why they had not been standardized in the past. There were certain regulations covering the fitting of gas to vehicles which must be observed, copies of which could be obtained from any of the usual sources, but at the moment there was no standardization of fittings.

He was asked whether they could get the cylinders. They were getting a certain quantity, as many as they wanted at the moment. He could not tell them more than that. "If you send an enquiry to any of the makers of repute you will get an answer," he added.

New Development of the "Bag" System

Interesting development work on the use of gas stored in fabric bags for motor transport has been carried out by Mr. William R. Wintour, of Alfreton Street, S.E.17, who has placed at the disposal of garage proprietors a new type of bag intended primarily for use on light delivery vehicles. All that now remains, he says, is for the Gas Industry to encourage the use of gas, first by setting an example with its own vehicles and then by simplifying the facilities for filling the bags.

"GET there on Gas" is the slogan Mr. Wintour has adopted to persuade private car owners and users of light delivery vans to contribute to the national effort by saving petrol and utilizing gas in its place for road transport. He has introduced a specially constructed bag varying in capacity according to the size of the vehicle but carrying sufficient gas to run from 10 to 20 miles on each filling, depending on the power of the engine. Between fillings the vehicle can be run on petrol, which means that on a basis of six fillings a day a vehicle can run at least 100 miles with the consumption of about half a gallon of petrol used where necessary between filling stations.

Describing the results of his experiments, Mr. Wintour recently showed a "JOURNAL" representative one of the new double-fabric gas bags he has evolved with a view to maximum durability and efficiency. An adaptation of the simple principle of the football, with a gas-tight inner bag and a strong outer covering, the container is constructed on lines different from any hitherto used for this purpose. The inner bag holds the gas and the outer covering, made of a special waterproofed material, takes the strain of wind and weather conditions. The inner bag is anchored at the bottom, and the whole arrangement is fitted with a patented automatic collapsing device which overcomes the objectionable "ballooning" effect that was a noticeable feature of the bags used during the last war. As the gas is used the bag collapses concertina fashion into the cradle on the roof of the vehicle and lies conveniently flat. The device is so made that it not only counteracts wind pressure but continuously forces the unused gas towards the front end of the bag and thus helps to maintain a steady and even flow to the engine inlet.

The gas bag fits into a wooden box-frame fitted on to the roof of the vehicle and firmly bolted on to the front and back of the chassis. The cradle can be made in several designs to suit the body of the vehicle concerned. The simplest form is the crate, but the sides can be hinged so that if the bag is empty the frame collapses down over the bag and renders it easier for the vehicle to be accommodated in its ordinary garage. The carrier frame is

not necessarily a permanent fixture on the vehicle. The supports can be fitted with nuts to enable the frame and bag to be detached if the van or car is wanted for a long journey on petrol alone.

Originally designed to conform to the size of the body of the vehicle, the bags are now being made long enough to be carried in a cradle extended over the full length of the van, from bumper to bumper, thus considerably increasing the gas capacity. Bags have been made in sizes from 9 ft. by 4½ ft. by 4 ft., up to 30 ft. by 6 ft. by 4 ft., giving a range of capacity from 162 to 720 cu.ft. Taking 250 cu.ft. of gas as normally equivalent to one gallon of petrol, though there is a slight variation between strict thermal efficiency as engine efficiency, a 12 to 14 h.p. car with the smallest bag can travel from 14 to 18 miles on each filling.

No actual engine alteration is necessary. All that is needed is the addition of an air mixer to the controls which acts automatically with the foot accelerator. As a general rule a new carburettor is not needed. The air mixer can be easily fitted to any modern type of carburettor, and generally speaking there are no other adjustments necessary. While the system is applicable to all types of internal combustion engined road vehicles and has actually been perfected on a small private Vauxhall car, it is intended in the main for light delivery vans whose radius of operation renders it convenient for their gas bags to be refilled at suitable points on their routes. The initial cost of conversion is so low that from a financial point of view the change over from petrol to gas is a very sound proposition. Even allowing for garage filling charges and the increase in the price of gas there is an economic advantage over petrol, an advantage that will become more pronounced in proportion to any rise in the price of petrol. So far as the question of efficiency is concerned gas has been found almost equal to petrol in acceleration and pick-up, while actual running is smoother and sweeter than it usually is on petrol.

Mr. Wintour's idea is to supply the gas bags and equipment to garage proprietors, who will collect appropriate fitting charges from their customers and draw a recognized trade discount on the sale of the bags. As regards the cradles, the details are governed by the size and shape of the vehicles to be converted, and designs will be supplied to the garages who will make their own arrangements for the carpentry work necessary in the construction of the frames.

Mr. Wintour feels that gas undertakings should afford much more encouragement than they are at present showing, first by running some of their own vehicles on gas, suitably advertised, and secondly by making it more convenient for garages to install the necessary standpipes and meters for filling the bags. It has been found possible to fill a bag from an ordinary domestic supply, but the practice is clearly one that should be discouraged because of the dangers involved, and it should be rendered unnecessary by the provision of proper facilities at the recognized filling stations, where an average sized bag could be filled in about seven minutes. For establishments such as laundries, where several vehicles will probably be converted, it might be advantageous to provide filling equipment on the premises. In both cases the initial installation costs should bear some relation to the purposes for which the equipment is required. A heavy "cash down" charge would probably deter many garage owners from adopting gas, whereas if a smaller charge, followed by deferred payments based on the number of fillings or the volume of gas sold, were made it is believed that a very large number of such owners would take up the sale of gas enthusiastically.

Economics of Benzole Recovery

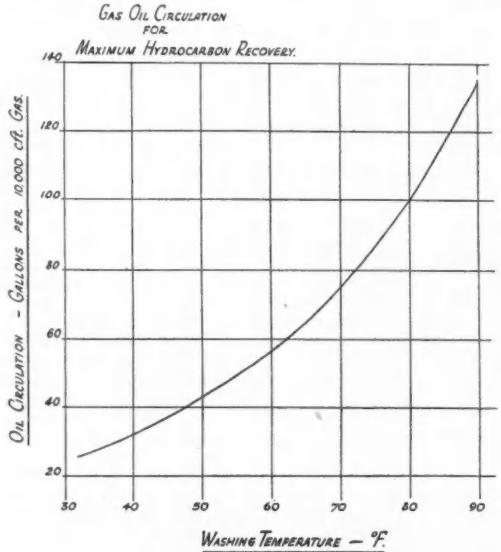
Further Contribution to the Discussion on Mr. A. C. Rea's North British Paper

Mr. **J. Watson Napier:** Mr. Rea says that he has no standard method for determining oil circulation but sets out three tables giving different rates for various gas rates. These tables are obviously for the use of a workman in controlling the plant, and as such are useful. Mr. Rea offers no explanation of when he uses each table. The tables are not quite consistent, but when expressed as gallons circulated per 10,000 cu.ft. of gas, they are approximately as follows:

Table 1.—42 gallons/10,000 cu.ft. per hour.
" 2.—50 " " " "
" 3.—60 " " " "

Anyone who has operated a benzole plant summer and winter knows that more oil is required per unit of gas in summer than in winter to give the same yield of benzole. What is not generally known is the extent of the variations required. Mr. Rea's tables are apparently an attempt to take care of this variation.

From a fundamental survey of the basic physical characteristics of the absorption process, and making due allowance for type of oil, washing efficiency, &c., it is possible to calculate the necessary oil circulation to give maximum recovery at any washing temperature. The attached curve shows the oil rates on this basis for a normal gas oil.



At first sight those will be considered by gas-works engineers to be abnormally high, but it should be made clear that they are for maximum recovery (with a good, well-designed washer) and not for economic recovery—*i.e.*, by circulating only 50% of the quantities stated it might be possible to obtain, say, 80% of the maximum recovery, and this might be considered economic in steam, water, and power. Under war conditions, it is important to note that increase in oil circulation will give increased recovery. It is interesting to note that coke oven plants commonly circulate 90-100 gallons per 10,000 cu.ft. at 22° C. (72° F.), which point lies above the curve.

The chief thing to be learned from this curve, and one which seems to be imperfectly understood, is the importance of varying oil circulation with variation in temperature; and the extent to which this is necessary may be amazing to some—*e.g.*, at 50° F. the oil rate is 43 gallons; at 75° F. it is practically double this. Those temperatures are within the possible winter and summer variations; how many operators double the oil circulation? A natural deduction from the curve is the importance of low-temperature cooling water and adequate oil cooling surface to give economic working in summer.

It is interesting to compare Mr. Rea's figures with the curve given.

Mr. Rea replied as follows: I am obliged for your observations and graph on oil circulation in relation to temperature for maximum recovery. The benzole recovery at Perth is used as a secondary control of calorific value. Conditions of carbonization are maintained reasonably constant as to throughput and heats. Back pressure and steam are varied to obtain the required calorific value of gas. Maximum benzole recovery is aimed at, but at times this has to be sacrificed in the prime interest of maintaining the declared gas value. It is here that the circulation table is utilized for instructing variations in recovery.

The range of Circulation on my three tables is from 40-70 gallons per 10,000 cu.ft. of gas, corresponding on your graph to a temperature range of 47°-68° F., which covers normal working conditions in summer and winter, though our extreme range of debenzolized gas oil temperature is 52°-86° F.

In practice there is also a difference in benzole absorption between day and night due to change in temperature, the change being noticed in the lowering gas calorific value during the night.

Referring to the actual results in the two tests quoted in my Paper, the oil circulations are 47 and 67 gallons per 10,000 cu.ft. at oil temperatures of 53° and 70° F., which on your table corresponds to circulations of 47 and 75 gallons per 10,000 cu.ft. of gas. The benzole recovery is 71 and 77% respectively.

You state that your graph shows the circulation in relation to temperature of normal gas oil for maximum recovery. This is borne out fairly well in the November tests where the actual circulation of 47 gallons per 10,000 cu.ft. corresponds with that shown on the graph, and the hydrocarbon recovery figure is 93%.

The naphtha in the June test was returned to the wash oil, so a full comparison cannot be made.

Draft British Standard Specification (A.R.P. Series) for Street Lighting under Wartime Conditions

It is anticipated that a Specification prepared under the ægis of a Joint Committee of the Illuminating Engineering Society and the Home Office (A.R.P. Department) will be published by the British Standards Institution within the next few days. In the meantime we are allowed to publish the following draft, which, we would make it clear, is still subject to alteration. No major alterations, however, are expected.

1. *Scope.*—This Specification lays down the technical requirements for the provision of a measure of lighting for use in streets, under the special requirements imposed by war-time conditions.

The order of illumination, while very low,* will provide some comfort and convenience to users of the streets. It will not be such as to call for any adjustment of the intensities of lighting of existing "aids to movement."

It is not intended that new columns should be erected to carry fittings for the provision of the low-level illumination in accordance with this Specification. The fittings should be mounted on columns selected from those existing.

Provision has been made for a range of mounting heights at present in general use, by prescribing standard light distributions.

NOMINAL 10 FT. MOUNTING HEIGHT

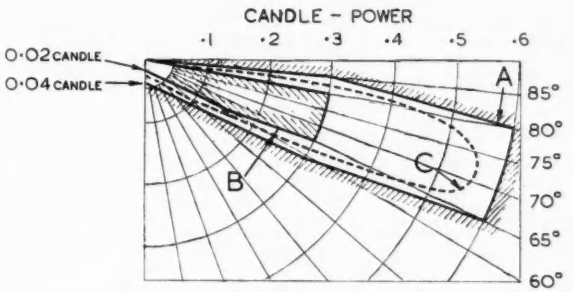


Fig. 1

2. *Illumination.*—The illumination on a horizontal surface at road level prescribed by this Specification is 0.0002 foot-candle. It is recognized that complete uniformity cannot be achieved, but the general level of illumination will approach closely to the above value and will nowhere exceed 0.0004 foot-candle.

These levels will not be exceeded in practice when the light distributions specified in Clause 3 are employed in the manner prescribed in the Specification. It is not the intention of the Specification that measurements of illumination in the street shall serve as a performance test.

NOMINAL 15 FT. MOUNTING HEIGHT

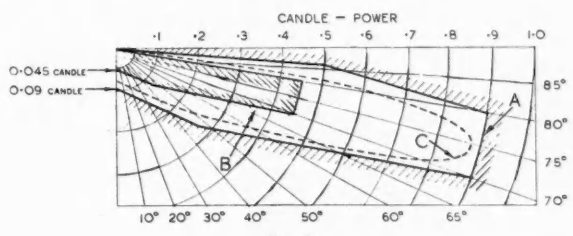


Fig. 2

The light shall be white as provided by an ordinary gas mantle operating normally, or by a tungsten lamp at normal voltages.

3. *Light Distribution.*—The polar curve of the candle-power distribution of the lighting fitting when equipped with the lamp or mantle specified by the manufacturer shall at all points lie inside the limiting curve marked "A" in Figs. 1, 2, or 3, according to the appropriate nominal mounting height (*see* Clause 4). Within 60° in azimuth on either side of the direction of the street axis (*see* Clause 8) the curve shall lie outside the corresponding limiting curve "B."

In illustration of the use of the limits a typical curve marked "C" is shown dotted in each figure.

Electric lamps used in fittings to furnish these light distributions shall be pearl lamps and shall comply with British Standard Specification No. 161.

4. *Mounting Height and Spacing.*—The light distributions prescribed in Clause 3 are associated with nominal mounting heights of 10, 15 and 20 ft. respectively. Fittings having these distributions may be mounted at heights as shown below, provided that the spacing of lighting fittings, measured along a line joining them in plan, is not less than 100 ft.:

Range of mounting heights for which the fitting may be used.	Nominal mounting height.
9 ft.—14 ft.	10 ft.
14 ft.—19 ft.	15 ft.
19 ft. and upwards.	20 ft.

Where columns are spaced at less than 100 ft. but at distances greater than 75 ft., and where it is inconvenient to use every second or third column, the fittings may be mounted at heights as shown below:

Actual mounting height.	Fittings adopted to be suitable for nominal mounting height of.
14 ft.—19 ft.	10 ft.
19 ft. and upwards.	15 ft.

To provide for spacings less than 100 ft. where the actual mounting height is less than 14 ft., an additional standard distribution curve is in preparation.

5. *Mounting and Erection.*—The lighting fittings shall be fixed vertically and, if necessary, correctly oriented. They shall be fixed with sufficient rigidity to prevent the emission of any light above the horizontal and to prevent rotation. Those parts of the columns close to the light sources shall not be unduly bright. Where units are closely adjacent to light-coloured vertical surfaces or expanses of water blackened side-screens shall be provided to prevent direct light falling upon such surfaces. These screens shall not reflect appreciable light above the horizontal.

NOMINAL 20 FT. MOUNTING HEIGHT

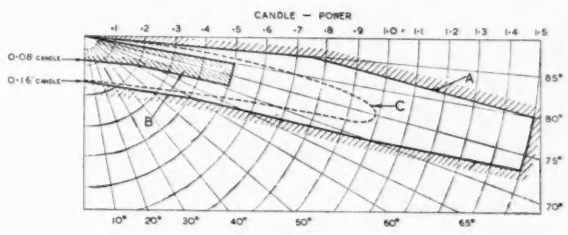


Fig. 3

Where fittings complying with this specification are attached to existing lanterns steps must be taken to prevent interference with the light distribution and in particular to prevent light being reflected in an upward direction by glass panels or any part of the complete lighting fitting.

6. *Construction.*—The construction of lighting fittings complying with this Specification shall be such that:

(*a*) those parts which control the optical properties shall not be liable to variation or derangement in maintenance or use;

(*b*) the materials and construction shall be robust and shall not be subject to such deterioration in service as to be likely to bring the photometric performance outside the limits laid down in Clauses 2 and 3.

7. *Photometric Testing.*—The lighting fitting shall be assembled in accordance with the manufacturer's instructions, with a test lamp or mantle and burner of the required type.

* This illumination, which is minute in comparison with that afforded by normal street lighting, is of the same order as that afforded by bright starlight on a clear moonless night.

The candle-power distribution shall be determined by a photometer, the receiving surface of which is not less than 2 ft. from the light source.

For a lighting fitting using an electric lamp, the test lamp shall comply with B.S. 161, and its luminous output shall be ascertained for the voltage at which the test is made.

In the case of electric lamps, the results shall be multiplied by the ratio of the specified mean initial luminous output of the lamp at rated voltage to the luminous output of the test lamp as ascertained in accordance with the third paragraph of this clause.

All gas conversion fittings, or electrical conversion fittings which employ any optical parts of existing lanterns, shall be tested complete with a typical lantern for which the conversion is designed.

Gas fittings shall be supplied complete with mantle and shall be tested at the pressure and B.Th.U. rate as specified by the manufacturer.

The candle-power distribution thus obtained, when plotted as a polar curve, shall comply with Clause 3. If the polar curve thus obtained falls outside these limits at any point, the lighting fitting shall be deemed not to comply with this Specification.

The manufacturer shall be given the opportunity of attending at the testing establishment, to ensure that the fitting is properly assembled and operated.

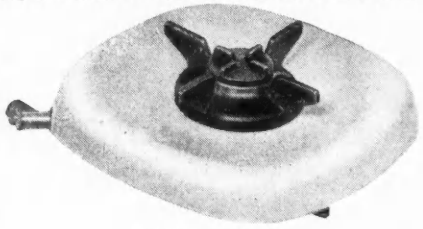
8. *Marking.*—Lighting fittings complying with Clauses 3 and 6 of this Specification shall bear the certification mark of the British Standards Institution. They shall also be marked with the appropriate nominal mounting height and size of lamp or mantle, and, if necessary, with an indication of the correct orientation with respect to the direction of the street.

Note.—Particulars of the conditions under which licences for the use of the Institution's registered certification mark may be granted to manufacturers of lighting fittings may be obtained on application to the Director, British Standards Institution.

Trade News

Modernising the Small Things

A new boiling burner (No. 254) just placed on the market by R. & A. Main, Ltd., is a further contribution to better and more attractive apparatus for the gas user. This high efficiency burner is of the flat-flame type, and is stated to have a maximum consumption of 20 cu.ft. of 500 B.Th.U. gas per hour. The injector has gas-and-air adjustment. The pot supports over the burner are 6 in. in diameter, and so provide a secure rest for utensils larger than average size.



With Enamelled Tray

Without Tray

The burner may be obtained either with or without the enamelled spillage tray, which is "dished" to hold nearly half-a-pint of liquid.

Working of Prepayment Meters

A leaflet just issued by George Wilson Gas Meters, Ltd., suggests that the point of trouble with prepayment meters is at the automatic prepayment value. Why, it goes on to ask, should trouble develop at this point? The answer is given that it is because it is practically the first recipient of the flow of gas into the meter and it is possible that particles of impurity may be carried on to the seating of the valve, particularly due to disturbances of the pipes during the changing of the meter. The subject of a quick closing valve was brought much to the fore a few years ago, and the results of a conjunction of such a valve with high consumption gas appliances, the leaflet continues, leads to excessive strain and consequent trouble only to be prevented by a device which will limit the strain on a meter.

The operation of the "Auto" in conjunction with the prepayment attachment, working under modern conditions and high consumption gas appliances, calls for its operation continuously, especially where 1d. meters are used instead of 1s., or where optional meters are in use and the consumer uses the 1d. in preference to the 1s. As some connecting link between the "Auto" valve and the prepayment attachment has to be used, this may be in the shape of a cam or lever operated by a cam which, of necessity, exerts a strain on the prepayment meter which is greatly increased if the "Auto" valve is in a supposedly "closed-off" position, but, due to a particle of foreign matter, is unable to complete its function by sealing the gas. In such cases, a certain amount of gas will pass the "Auto" valve and continue to operate the prepayment mechanism supposedly, at this moment, to have completed its operation and be in a "closed-off" position.

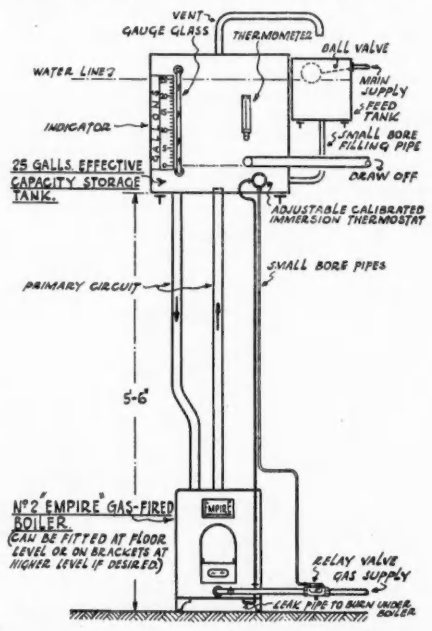
If the meter is constructed correctly, the reason the prepayment attachment will continue to work is that the gas which passes through the "Auto" valve will operate the meter until the time that the "Auto" valve has completely closed. Therefore, should there be a deposit on the surface of this valve, it is impossible for it to move further and a breakage or distortion takes place, while worn crank worms follow.

It is essential that the attachment or drive should not be strained. Realizing that friction drives or coin wheels "creep" meant cash shortage, George Wilson Gas Meters, Ltd., introduced the compensating valve which, states the leaflet, covers the position in every way and is inactive in the ordinary course of events. The automatic prepayment valve need only have foreign matter on the seat once to damage the meter. The valve may clean itself, but the damage has been done.

The diaphragms, although remote from the prepayment valve, nevertheless enter largely into the question discussed, for the motive power of the meter is dependent upon them. The strain which is put upon the mechanism of a meter through a faulty prepayment valve (without means of compensation) is great. However, by limiting the strain on the attachment, the leaflet concludes, the life of the heart of the meter is considerably lengthened, and therefore the meter as a whole must benefit.

An Automatically Controlled Tempering Tank

The accompanying diagram illustrates an apparatus recently designed by Thomas Potteron (Heating Engineers), Ltd., for use in bakehouses where a regulated quantity of water at a given temperature is required for the mix. This is not, of course, a new subject, but it constitutes, nevertheless, a new method of application and one more readily achieved with the use of gas than



with other forms of fuel—owing primarily to the greater recovery rate of gas. This particular design of plant is being supplied to Messrs. Hemmings, Ltd., and it is hoped that the demand will call for a number of similar sets. While many bakers know by experience their exact requirements, an automatic plant of this nature eliminates any possibility of error and renders the whole process more fool-proof as well as infinitely more reliable.

Refractories for Gas and Coke Burning Appliances

Extract from the 30th Report of the Refractory Materials Joint Committee

By
L. R. BARRETT[1], B.A., B.Sc., M.S.,
and
A. T. GREEN, F.I.C., F.Inst.P.

Communication No. 218

It has been felt for some time that there was room for improvement in the refractories used in gas appliances. In some cases a better selection of existing refractories and alteration in design was all that was necessary, whilst in other cases further progress was dependent on the development of new or improved refractory materials, especially those of low and high conductivity. At the instance of the Research Executive Committee of The Institution of Gas Engineers, the co-operation of several large Gas Undertakings and furnace builders was sought and readily given. The experience and information on all types of gas appliances which they were able to give has been combined with a search of the literature into a survey which should bring out the trends and requirements in refractories for gas appliances at the present day.

High-Temperature Insulating Materials

Gas-Fire Backs

Gas fires which warm the room by radiation are fitted with a fire back of refractory material, situated immediately behind and on each side of the bank of radiants and sometimes extending above them. The fire back fits into the metal casting forming the framework of the fire and is kept in place by pressure at the back, which can be applied with a screw. The fire back is usually found to be in one piece of fireclay or other material, but this practice may be departed from in the future. Many of the gas fires in use have a narrow space behind the radiants which tapers to nothing towards the top. In a type developed by the Gas Light and Coke Company the radiant is in the form of a box with openings in the front. The back of this radiant should fit close to the fire back to prevent a current of cold air rising between the fire back and the back of the radiants, which would cool the latter. To satisfy the requirements of appearance and economy, it has been customary to limit the thickness of the fire back to 2 in.

The material of the fire back is usually burned fireclay, but some are of higher heat resistivity, being composed of cellulated clay, or possess a diatomite base. The weight of the fire back varies accordingly. The colour may be white, buff or pink. A wash is sometimes applied to obscure an unattractive colour, since part of the fire back may be visible through the radiants as well as at the sides and, occasionally, a good deal above them. Reasonable strength is required in the fire back to resist the somewhat rough usage received in transport from the refractory plant to the gas fire assemblers, and thence to the Gas Undertaking. However, mechanical breakage is not an important source of damage.

When the gas fire is lit the radiants are raised from cold to 1,000°-1,050° C. (1,830°-1,920° F.) in 10-15 min., whilst the fire-back face attains in the same time a temperature of 900° C. (1,650° F.). The rate of cooling on extinguishing the flames is about the same as the rate of heating up. When it is considered that this thermal shock is received perhaps 2,000 times during the normal life of the fire (5,000 to 15,000 hr. running), it will be clear that the first essential property of the fire back is resistance to the strains set up in heating and cooling. Amongst the gas fires returned to the Liverpool Gas Company for overhaul and repair are some with the refractory back cracked by thermal shock, chiefly down the centre. The liability to this failure is probably associated with the use of the Duplex tap, which enables the centre burners to remain lighted while the side burners are extinguished. The shape of the back also induces a greater tendency to this fault, as wide short backs crack more frequently than those which are tall and narrow. It is suggested that the number of fire backs which crack in use could be reduced by discontinuing the use of shapes which are abnormally subject to this failure or by arranging for the strain to be relieved by a tongue-and-groove joint down the centre.

The primary function of the fire back is to raise the temperature of the radiants by hindering the transmission of heat backwards and sideways. In this connexion the following analysis of the modes of dissipation of the heat generated by the combustion of the gas is interesting:

(i) Radiation into the room ..	50 to 55 per cent
(ii) Conduction through the back of the fire	5 per cent
(iii) Conduction to the front castings and thence into the room as convected heat	3 per cent
(iv) Convected heat up the flue ..	30 to 40 per cent

Increasing the thermal resistance of the brick raises the radiant efficiency more by producing a higher temperature on the radiating front than by reducing the already small back losses. A thin brick of low conductivity is found to be more effective than a thicker one of higher conductivity giving the same back heat loss. Heavily lagging the back of the fire behind the firebrick with slag wool or expanded mica has a surprisingly small effect on the radiant heat output. The bricks used in the best present-day fires have a conductivity of about 0.00035 c.g.s. units (1.0 British units).* The insulating materials tried for the fire back include moulded diatomite and asbestos compositions, which have cracked or disintegrated under the conditions of use, though mixtures of diatomite with other materials are successful. The temperature of the hot face of the fire back used behind radiants, namely, 900° C. (1,650° F.) is rather above the limiting safe temperature of most diatomite materials. There is some chance that ways of treating diatomite can be found, such as appear to be already used in the case of some diatomite bricks (see sample No. 17), tested by A. H. Jay and L. Lee[2], which suffered less than 1 per cent contraction at 1,200° C. (2,190° F.), which would enable satisfactory fire backs to be moulded, free from shrinkage in service. For the most part the thermal conductivity of diatomite bricks is less than the best cellulated clay bricks, so that there seems little prospect of a synthetic material surpassing diatomite for the range below 800° C. (1,470° F.). Therefore, for gas fire backs behind radiants, where resistivity to heat flow is of the first importance, diatomite treated to resist shrinkage is likely to give more all-round satisfaction than cellulated clay. The problem of protecting the diatomite from spalling is approached later.

A type of gas fire is now in course of development[3] in which loose radiants are eliminated. The chief radiating surface is the refractory fire back itself. To provide a space for combustion, in front of the fire back and at the proper distance from it is placed a screen of refractory material, which is itself only moderately hot on the side facing the room, through which the hot fire back can be seen. The

*c.g.s. units represent g. cal. transmitted per sec. per sq. cm. cross-section per cm. thickness per °C. temperature difference. To obtain values in B.Th.U. per hr. per sq. ft. per in. thickness per °F. difference (here called British units) multiply by 2,900.

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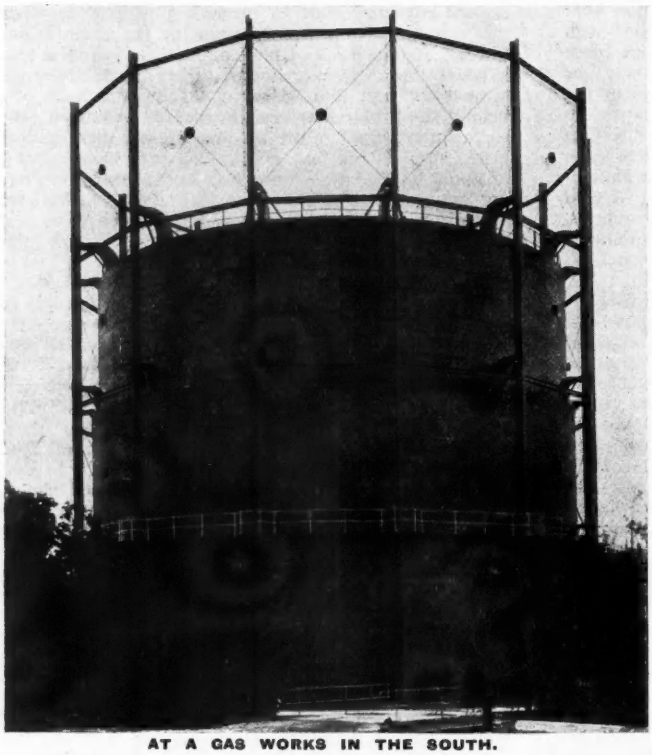

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refractory fire back is raised in temperature to 1,200° C. (2,200° F.) at a quick rate. The requirement here is for a non-spalling, non-shrinking fire back of the maximum resistivity to the passage of heat. To reduce the time which elapses in heating up to a comfortable-looking redness, the rate of penetration of heat should be slow, i.e., the thermal conductivity and specific heat should be low. Considerable work has been done by the South Metropolitan Gas Company in developing a suitable type of insulating back brick for a fire of this type. It has been found necessary to mould a composite back brick, the working face of which is of refractory insulating material to a depth of ¼ in., backed with diatomite for the rest of the thickness. To enhance the insulating properties of the diatomite portion of the back brick, it has been found advantageous to produce a series of laminations within the zone at which the temperature has dropped to 800°C. (1,470° F.).

The increased cost of manufacture of fire backs arising from the sizing necessary after firing should be eliminated if possible. Uniformity in the raw materials and process of manufacture and the use of the maximum amount of pre-fired, non-shrinking grog in the mix should reduce the variability in size.

Coke-Fire Backs

The use of coke in the open domestic fire is steadily gaining in popularity, particularly as it mitigates the smoke pollution problem in big cities. A demand has grown for a special fire back for such coke fires, which takes into account the existing knowledge of the most efficient ways of burning coke. The general features of domestic coke fire grates have been described by F. M. H. Taylor[4] and F. J. Eaton[5]. Coke-fire grates may be specially designed for the purpose or they may be adapted from existing coal-fire grates. The burning coke is supported on firebars, on which it is retained at the back and sides by fireclay slabs—the fire back. The back brick itself is either in one piece or split into two halves, anticipating the crack which may appear in use. On either side of the back brick are two side pieces, whilst above the back brick and slanting forward to restrict the flue opening and throw forward heat is a fourth piece, which is often flat, but may be of "chair-back" shape. Occasionally more than four pieces circumscribe the heart of the fire. At the present time work is in progress by P. O. Rosin on the aerodynamic aspects of grate and chimney design for solid fuel fires. Among the conclusions so far reached[6] are that the fire back should be so designed as to be as hot as possible and should preferably be convex and not possess an exaggerated slope.

The fireclay fire back is used for two reasons: to act as a refractory support in positions where the absence of a cooling current of air would restrict the life of metal, and to prevent undue loss of heat by conduction through the back of the fire. The use of insulating refractory material is not recommended by the South Metropolitan Gas Company, since although it is advantageous with regard to the rate of ignition, it is generally found that the fire is sufficiently hot for comfort and the fuel consumption would be unnecessarily increased. Recently, W. Davidson and H. Hartley[7] have measured the gross overall radiant efficiency of solid fuel fires, using both slag wool and brick rubble behind the fire back. It was found that the thermal efficiency using slag wool was almost 6 per cent (i.e., 2 units) higher than that attained with the rubble packing. A. Blackie reported that in similar tests the total radiation was increased about 9 per cent when the lagging was changed from brick rubble to slag wool. Of this, about 4 per cent was due to the higher temperature and heat storage of the grate back and sides and the rest to the higher temperature of the fire itself and greater proportion of fuel used.

Eaton[5] records the temperatures attained at different points in a coke-fire back assembly. The highest temperature is 1,225° C. (2,240° F.) when clinker may be met. The rate at which coke is ignited when using gas for the purpose calls for a refractory of low and uniform thermal expansion to reduce the liability to cracking, whilst the comparatively high temperature reached necessitates a fire back of somewhat higher refractoriness than is adequate for a coal-fire back. Since the clinker may tend to adhere to the back brick, an

Christmas

1939

To all friends on the home front, we extend hearty greetings . . . . In spite of everything, let us still keep our Christmas merry, and carry on with the hope that 1940 will bring back universal Orderliness and Peace.

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aluminous brick with a small percentage of iron in a well-dispersed form is preferred. Taylor[4] believes the best type of fire back has the composition 64 per cent silica, 34 per cent alumina, not more than 1 per cent alkali and a small proportion of iron oxide. A porosity of between 22 and 28 per cent is usual. Siliceous clays and those containing added quartz have given considerable trouble in regard to fracturing and slag attack. A dry-pressed brick possesses a surface suitable for coke-fire backs.

At present a completely satisfactory cement for the joints between the component parts of the coke-fire back has not been found. It should adhere and harden at about 300° C. (570° F.).

From the information which has been collected it is evident that an experimental survey of the conditions governing the durability of coke-fire backs should be made. A clear conception of the temperature gradients which can be set up during use must be obtained. Such knowledge will react to improve the shape and design of the backs, and also will indicate the type of refractory material likely to give adequate service.

Insulation of Furnaces

Diatomite Lagging.—The application of a layer of diatomite brick or powder to the cool face of a furnace, or other high-temperature installation, is common practice and is well understood. Its effect is to raise the mean temperature, and, consequently, the heat stored in the refractory brickwork, but to reduce the rate of loss of heat through the walls and aid the attainment of uniformity of temperature throughout the furnace. For continuous furnaces the practice is good, but may not always be advisable on the score of economy, for intermittent furnaces. Used inexpertly, insulation of this kind has sometimes thrown discredit on the principle of heat insulation and on the refractories employed, for the fuel bill has been increased and the refractories have not withstood the load put upon them in cases where most of the brickwork was near the point of subsidence.

Insulating Firebrick.—The cellular structure of diatomaceous earth products begins to break down at temperatures in the region of 800° to 1,000° C. (1,470° to 1,830° F.). The hot face of brickwork shrinks, whilst powder settles down. The need for insulation which could be put in contact with the furnace interior has long been felt, but has been adequately satisfied only in the last ten years. By calcining, pressing, and chemical treatment, diatomite bricks were made able to withstand 1,100° C. (2,000° F.), but these were not able to withstand flame impingement at that temperature. The development of a type of brick, appropriately called insulating firebrick, which is now claimed to be suitable for facing walls of furnaces in which a clean soaking heat of 1,400° C. (2,550° F.) is maintained, makes possible the construction of furnaces containing no dense refractory materials. Though porous magnesite and silica bricks have been made, an alumino-silicate brick is generally understood by the term "insulating firebrick." With a porosity of about 65 per cent, these bricks are one-half to one-third of the weight of ordinary firebricks and are of correspondingly reduced thermal capacity. The smaller proportion of dense material reduces their strength, cold and hot, and makes them less resistant than ordinary clay firebricks to slags and the cutting action of flames.

The permeability is often high, though it may be low; whilst the spalling resistance of these bricks as a class tends to be lower than ordinary firebrick. Their great merit lies in a thermal conductivity about one-fourth that of ordinary firebrick, though somewhat greater than diatomite bricks. A range of products is now commercially available, amongst which, broadly speaking, the thermal conductivity and capacity is lower the lower the recommended safe upper limit of temperature.

Heat Loss from Furnace Walls.—Many examples are cited in the literature of the calculated and actual saving of fuel and time made possible by the use of insulation. As an example, reference may be made to some illustrative calculations by A. V. Leun,[8] of the Bethlehem Steel Corporation, in which the heat economy of a furnace operated continuously or intermittently for various periods is set out so that the effect of reconstructing it can be seen, first by adding diatomite lagging and then by replacing the dense refractories by light-weight refractories.

For continuous use the heat losses are proportional to the heat lost by conduction through the walls. In this case a layer of diatomite or other insulation provides a considerable measure of impermeability to heat, but for discontinuous use, especially when the furnace is shut down over night, diatomite is of much less value and may be a source of loss. Here the heat lost which has been stored in the dense brickwork preponderates over that lost during operation. By the use of insulating firebrick alone or with a backing of diatomite block, the heat lost in continuous running is further reduced, but at greater initial cost than uninsulated firebrick. However, calculations show that the extra cost is saved in one month of working, shutting down each week-end, with gas at 3d. per therm. If the gas had cost twice as much, then it would take roughly half as long to pay for the increased capital cost of the furnace. The fuel savings are in reality greater than this, because for each therm passing through the wall or stored in it there is perhaps another therm passing away in the hot flue gases. W. Goldsborough and S. G. Throssell[9] make this point clear. The general opinion in America (where the price of gas may be 1d. per therm) seems to be that the extra cost of insulating refractories in a furnace is made up in six to fifteen months of running. A further advantage of using insulating refractories wholly in a continuous furnace is apparent when a shut-down is necessary to effect repairs. Workmen can enter the furnace sooner than if dense refractories had been incorporated in the construction, thus saving wasteful unproductive hours. H. M. Christman[10] relates that when a skid-rail broke in a copper billet-heating furnace, piling up billets so that the roof was damaged, 20 hr. were saved, equivalent to more than the whole cost of the furnace.

There can be no doubt, whatever the local conditions of price of town gas, that insulation carried from the cold face right up to and in contact with the furnace interior is the most economical method of construction and should always be used, unless the life of the bricks is too short owing to slag action, abrasion, or some other adverse conditions or the process depends on abstracting a large amount of heat at intervals from dense brickwork.

Comparative tests of two small surface-combustion town-gas-fired oven furnaces were reported by R. P. Wilson[11]. These furnaces were identical in dimensions, save that in No. 2 a 4½-in. first-quality firebrick was used in front of 2½ in. of insulating brick, whereas in No. 1 the same thickness of insulating firebrick was used. The hearth was 10 in. in width by 18 in. in length, and the door opening was 10 in. in width by 7½ in. in height. The floor was of the same construction as the walls and arch. Run on four successive days at a public exhibition, the time to heat up to 1,090° C. (2,000° F.) averaged 1 hr. 25 min. and 4 hr. 30 min. for Nos. 1 and 2 respectively, using a gas rate as nearly the same for each as possible. The gas used to heat up averaged 350 cu.ft. and 1,170 cu.ft. (calorific value=534), whilst the gas to hold at constant temperature averaged 107 and 200 cu.ft. per hr. respectively.

Calculations made by J. D. Keller[12] show similar economies of time and fuel. Two furnaces, one of firebrick and the other of insulating firebrick, erected at the Carnegie Institute of Technology, Pittsburgh, fully confirmed these calculations.

It should be clear from these examples that the substitution of insulating firebrick for ordinary firebrick in furnace construction can effect considerable economy of time and gas fuel. A further example will show that it is quite important to choose the firebricks which have the least thermal conductivity and capacity consistent with adequate heat and pressure-resisting properties. M. J. Terman[13], of the Babcock and Wilcox Company, compares two slot-type heating furnaces of identical dimensions, one constructed of insulating firebrick weighing 30 lb. per cu.ft. and the other of 47·5 lb. per cu.ft. The hearth size was 12 in. × 40 in., the walls were 13½ in. in height, and the slot 3 in. × 40 in. The burner equipment, gas supply, and method of construction were the same for both. The side walls and end walls were 4½ in. in thickness and the roof 9 in. in thickness. The bottoms were of 1-in. plastic chrome laid on 6½ in. of fireclay brick, and that again laid on 2½ in. of insulating

brick. The operating temperature was 1,150° C. (2,100° F.), and the stock heated was ½ in. × 7/16 in. × 6 in. in dimensions.

TABLE 1.—*Comparison of Slot-Type Heating Furnaces*

	No. 1.	No. 2.
Density of insulating firebrick, lb. per cu. ft. ...	30	47·5
Time to heat up, min.	21	36
Gas to heat up, cu. ft.	244	438
Total cycle, including heating up, hr. ...	8	8
Total gas used in 8 hr., cu. ft.	5,095	6,087
Total number of pieces heated	1,600	1,320
Total of stock heated, lb.	2,073	1,710
Pieces per hr.	200	165
Cu. ft. of gas per lb. of steel heated	2·46	3·56

Per cent savings by using No. 1 brick:

In time to heat up	41·7
In fuel to heat up	44·3
In fuel per lb. of stock heated ..	30·9
Per cent increase in production ..	21·2

Calculated or actual heat and time savings by the substitution of insulating firebricks for ordinary firebricks are reported by H. V. Allen,[14] R. S. Bradley,[15] H. M. Christman,[10] J. G. Coutant,[16] W. M. Hepburn,[17] J. D. Keller,[18] W. Hind,[19] E. C. Lloyd,[20], J. B. Nealey,[21] C. L. Norton, Jr.,[22] F. H. Norton,[23] E. Senfter,[24] and W. Trinks,[25] as well as those already described.

Summing up in general terms, it may be said that the lagging of firebrick walls with diatomite brick will halve the heat lost by conduction through the walls, but the replacement of the firebrick by a lesser thickness of insulating firebrick will still further decrease the heat lost by conduction and will, moreover, reduce the stored heat by five-sixths. Wastage of the heat stored in the brickwork at shut-downs is the major loss if the furnace is in use for less than a week at a time, so that it is imperative to use hot-face insulation, if at all possible, in intermittent furnaces. A further advantage is the reduction in heating-up and cooling time proportionate to the reduced thermal capacity. The extra cost of the insulating firebrick will be offset in a year or less of running continuous furnaces and in a few months in intermittent furnaces.

LITERATURE REFERENCES

1 *Bull. B.R.R.A.*, 1939, **50,** 28.
2 *Trans. Ceram. Soc.*, 1938, **37,** 151.
3 See, for example, *Gas World,* 1937, **107,** 26, 48.
4 *Gas J.*, 1936, **214,** 580.
5 *ibid.*, 1937, **218,** 43.
6 *ibid.*, 1939, **225,**, 559.
7 *Trans. Inst. Gas Eng.*, 1938-39, **88,** 441.
8 *Trans. Amer. Foundrymen's Assoc.*, 1937, **8,** 274.
9 *Brit. Steelmaker*, 1937, **3,** 295.
10 *Cer. Ind.*, 1934, **23,** 81.
11 *Proc. Amer. Gas Assoc.*, 1934, p. 702.
12 *Amer. Refract. Inst. Bull.*, 1934, No. 53 ; *Iron and Steel Ind.*, 1937, **10,** 587.
13 *Iron and Steel Eng.*, 1934, **11,** 218.
14 *Trans. Ceram. Soc.*, 1936, **35,** 437.
15 *Heat Treating and Forging*, 1937, **23,** 349.
16 *ibid.*, 1937, **23,** 630.
17 *J. Amer. Ceram. Soc.*, 1935, **18,** 13.
18 *ibid.*, 1934, **17,** 77.
19 *Gas World, Ind. Gas Supp.*, 1937, **9,** 49.
20 *Steel*, 1934, **94,** 43.
21 *Amer. Gas Assoc. Monthly*, 1936, **18,** 358.
22 *Ind. Heating*, 1935, **2,** 654, 668.
23 *Trans. Ceram. Soc.*, 1936, **35,** 301.
24 *ibid.*, 1935, **34,** 82A.
25 "Industrial Furnaces", 1934, Vol. 1.

(To be continued.)

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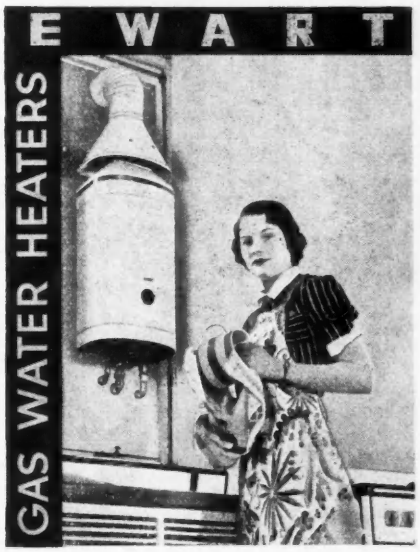

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Current Sales of Gas Products

The London Market

Dec. 18.

There are no changes to record in the prices of tar products in the London market. to-day's values being as under :

Pitch about 32s. 6d. per ton f.o.b.
Creosote about 5d. per gallon.
Refined tar 3¾d. to 4d.
Toluole is now controlled by the Ministry of Supply Order No. 1, which fixes the maximum price at which this material may be sold.
Pure benzole about 1s. 10d.
95/160 solvent naphtha about 1s. 11d.
90/160 pyridine 14s. to 14s. 6d.
All per gallon naked.
Refined naphthalene crystals about £16 per ton in bags.
All *ex* makers' works.

The Provinces

Dec. 18.

Crude Gas-Works Tar, 17s. 6d. to 22s. 6d.

To avoid misunderstanding, it is necessary to state that the above price is not claimed to represent a market value. It is a price worked out from week to week upon a system which has been used for many years as a basis for the fixing of certain contracts for crude tar of varying qualities in different areas.

The average prices of gas-works products during the week were : Pitch—East Coast, 32s. 6d. to 35s. f.o.b. West Coast—Manchester, Liverpool, Clyde, 32s. 6d. to 35s.* Toluole, naked, North, 1s. 9½d. (Controlled by the Ministry of Supply Order No. 1, which fixes the maximum price at which this material may be sold). Coal tar, crude naphtha, in bulk, North, 8½d. to 9d. Solvent naphtha, naked, North, 1s. 7d. to 1s. 8d. Heavy naphtha, North, 1s. 3½d. to 1s. 4½d. Creosote, *ex* works, in bulk, North, liquid and salty, 4¼d. to 4¾d.; Scotland, 4¼d. to 4¾d.; low gravity, 4¼d. to 4¾d. Carbolic acid, 60's. 2s. 9d. to 3s. Naphthalene, £15 to £20. Salts, 75s. to 85s., bags included. Anthracene, "A" quality, 4½d. to 4¾d. per minimum 40% purely nominal. Heavy oil : Unfiltered anthracene oil, (min. gr. 1,080), 5¼d. to 5½d.; filtered heavy oil (min. gr. 1,080), 5¾d. to 6d.; heavy anthracene oil gr. less than 1,080 ,6d. to 6½d.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls, whatever they may be.

Scotland

GLASGOW, Dec. 16.

Trading during the week has been on a moderate scale both in the home and export markets. Prices generally are fairly well stabilized.

Crude gas-works tar.—Actual value is round 30s. to 32s. per ton *ex* works in bulk.

Pitch.—Vertical quality is procurable in substantial quantities at 23s. to 24s. per ton, f.o.b. for export, and round 20s. to 22s. 6d. per ton *ex* works in bulk for home trade.

Refined tar.—There is practically no demand but makers' prices are maintained at 3¾d. to 4d. per gallon in the home market, and 2¾d. per gallon for export, filled into buyers' packages at makers' works.

Creosote oil.—Some quite substantial business is being placed for both prompt and forward and prices remain firm as follows : Specification oil, 5d. to 5¼d. per gallon ; low gravity, 5¾d. to 6d. per gallon ; neutral oil, 5½d. to 5¾d. per gallon ; all *ex* works in bulk.

Cresylic acid.—Home business is quieter but export enquiries are increasing. Prices are unchanged as follows : Pale, 97/99%, 2s. 2d. to 2s. 4d. per gallon ; dark, 97/99%, 1s. 10d. to 2s. per gallon ; pale, 99/100%, 2s. 6d. to 2s. 9d. per gallon ; all *ex* works in buyers' packages.

Crude naphtha continues to be valued at 6d. to 6½d. per gallon *ex* works in bulk, according to quality.

Solvent naphtha.—90/160 grade is 1s. 7½d. to 1s. 8¼d. per gallon and 90/190 heavy naphtha is 1s. 3½d. to 1s. 4¼d. per gallon.

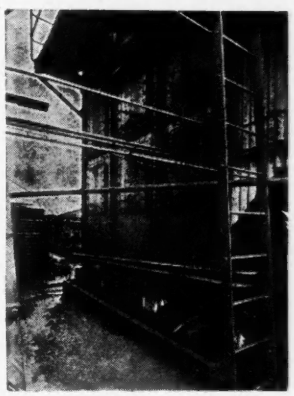
Motor benzole remains at 1s. 6d. to 1s. 7d. per gallon.

Pyridine is scarce with values nominal at 14s. to 15s. per gallon for 90/160 grade and 16s. to 17s. per gallon for 90/140 grade.

Contracts Advertised

Stoves.
Stockport Gas Department. [p. 638.]
Valves, &c.
Sidmouth Gas Department. [p. 638.]
C.I. Spun Pipes and Specials.
Sidmouth Gas Department. [p. 638.]
Station Governor.
Sidmouth Gas Department. [p. 638.]
Tar Pumps.
Sidmouth Gas Department. [p. 638.]

"Permac" Joints in a Gas Works.



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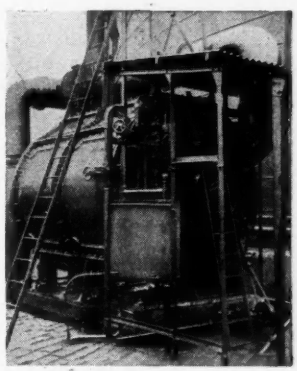

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GAS STOCKS AND SHARES

Business on the Stock Exchange last week was more active in several sections and prices generally remained firm. The gilt-edged market was an exception but, although the interest in this section eased up there were no serious reactions in prices. There was continued support for home rails and values were well maintained—Great Western ordinary being in good demand on Friday. A feature was the increased activity among leading industrial shares and with dealers short of supplies some appreciable gains were recorded. Increases in the commodity prices gave a fillip to tin and rubber shares during the greater part of the week, though a reactionary tendency set in at the close. The latest good dividend announcements among gold-mining companies led to more activity in this section.

The volume of business in the Gas Market continued very small and apart from ex dividend markings there were few price changes. In the Official List Alliance and Dublin 4% debenture reacted 5 points to 80 bringing it more into line with current quotations. This stock is closely held and rarely comes into the London market, the last recorded transaction being a year ago at 95¾. Gas Light units fell a further 6d. to 15s. 9d., and Gas Consolidation £1 shares dropped 2s. 6d. to 15s. 6d. Imperial Continental also suffered a further setback, closing 2½ points lower at 75; a year ago the quotation was 113½. It will be noticed that in several debenture stocks the margins have now been narrowed to 5 points. In the Supplementary List the chief feature was a rise of 5 points in the nominal quotation of Oxford ordinary to 140, but Colchester 6% preference reacted 7½ to 97½, although business was recorded at 102.

The effect of four months of war conditions on gas finances will be revealed in the forthcoming reports and accounts for the current year, which will be awaited with interest. Stockholders have already been warned that from a number of undertakings they must face reduced dividends, but it is to be hoped that this reduction will not be so heavy as during the last war.

Official Quotations on the London Stock Exchange

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 15	Rise or Fall on Week.
1,767,439	Sept. 4	8	8	Alliance & Dublin Ord. ...	115—125	...
374,000	June 19	4	4	Do. 4 p.c. Deb.	75—85	−5
877,576	Nov. 6	5	5	Asscd. Gas & Water U'd'ts Ord.	14/6—16/6	...
500,000	"	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	17/—19/—	...
535,545	"	4	4	Do. 4 p.c. Red. Cum. Pref.	16/—18/—	...
318,730	"	4	4	Do. 4 p.c. Irred. Cum. Pref.	15/—17/—	...
750,000	Sept. 18	3½	3½	Do. 3½ p.c. Red. Deb. ...	80—85	...
560,070	Aug. 21	7	7	Barnet Ord. 7 p.c. ...	110—120	...
300,000	Oct. 9	1/9⅔	1/4⅔	Bombay, Ltd.	19/6—20/6	...
181,185	Aug. 21	9½	9½	Bournemouth Sliding Scale	135—145	...
690,526	"	7	7	Do. 7 p.c. max.	115—125	...
493,960	"	6	6	Do. 6 p.c. Pref.	110—120	...
50,000	June 5	3	3	Do. 3 p.c. Deb.	70—75	...
362,025	"	4	4	Do. 4 p.c. Deb.	93—98	...
335,000	"	5	5	Do. 5 p.c. Deb.	105—110	...
357,900	Aug. 21	7½	7½	Brighton, &c., 6 p.c. Con.	105—110	...
689,955	"	6⅔	6⅔	Do. 5 p.c. Con.	100—105	...
205,500	"	6	6	Do. 6 p.c. 'B' Pref.	95—105	...
855,000	Sept. 18	8	7	British Ord.	90—100	...
100,000	June 19	7	7	Do. 7 p.c. Pref.	120—130	...
350,000	"	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	110—115	...
120,000	June 5	4	4	Do. 4 p.c. Red. Deb.	75—80	...
450,000	"	5	5	Do. 5 p.c. Red. Deb.	100—105	...
100,000	22 May '33	6	4	Cape Town, Ltd. ...	¼—¾	...
100,000	6 Nov. '33	4½	4½	Do. 4½ p.c. Pref.	1—3	...
150,000	June 19	4½	4½	Do. 4½ p.c. Deb.	58—68	...
626,860	July 17	6	6	Cardiff Con. Ord. ...	95—105	...
237,860	June 5	5	5	Do. 5 p.c. Red. Deb.	97—102	...
98,936	Oct. 9	2/−	2/−	Colombo Ord.	1 7/16—1 7/16	...
24,510	"	1/4⅜	1/4⅜	Do. 7 p.c. Pref. ...	20/6—22/6	...
739,453	Sept. 27	−/11.48	−/11.48	Colonial Gas Assn. Ltd. Ord.	15/—17/—	...
296,144	"	1/3.30	1/3.30	Do. 8 p.c. Pref. ...	20/6—22/6	...
1,775,005	July 31	4	4	Commercial Ord. ...	48—58	...
140,000	Aug. 21	4	4	Do. 4 p.c. Red. Pref.	88—93	...
620,000	De c. 11	3	3	Do. 3 p.c. Deb. ...	55—60*	...
286,344	Aug. 21	5	5	Do. 5 p.c. Deb. ...	85—95	...
200,000	"	3¾	3¾	Do. 3¾ p.c. Red. Deb.	94— 99	...
807,560	July 31	7	7	Croydon sliding scale ...	100—110	...
644,590	"	5	5	Do. max. div. ...	80—85	...
620,365	June 19	5	5	Do. 5 p.c. Deb. ...	90—100	...
208 660	Aug. 21	5	5	Dudley, Brierley Hill & Dist. Ord.	100—105	...
82,275	"	5	5	Do. 5 p.c. Con. Pref.	92—102	...
79,000	"	3¾	3¾	Do. 3¾ p.c. Red. Deb.	94—99	...
239,000	July 31	5	5	East Hull Ord. 5 p.c. ...	86—91	...
187,215	Aug. 21	6	5⅜	East Surrey Ord. 5 p.c.	98—103	...
176,211	June 5	5	5	Do. 5 p.c. Deb.	90—100	...
250,000	Nov. 13	8	4	Gas Consolidation Ord. 'B'	14/—17/—	−2/6
250,000	"	4	4	Do. 4 p.c. Red. Cum. Pref.	16/—18/—	...
9,172,463	July 31	5⅜	5⅜	Gas Light & Coke Ord. ...	15/3—16/3a	−/6
2,600,000	"	3½	3½	Do. 3½ p.c. max. ...	58—63	...
4,477,106	"	4	4	Do. 4 p.c. Con. Pref.	77—82	...
2,993,000	July 3	3¾	3¾	Do. 3¾ p.c. Red. Pref.	80—85	...
8,602,497	Nov. 27	3	3	Do. 3 p.c. Con. Deb.	68—73	...
3,642,770	"	5	5	Do. 5 p.c. Red. Deb.	100—105	...
1,500,000	"	4½	4½	Do. 4½ p.c. Red. Deb.	98—103	...
700,000	Sept. 4	3½	3½	Do. 3½ p.c. Red. Ded.	85—90	...
270,466	July 31	6	6	Harrogate New Cons. ...	95—100	...
157,500	Mar. 20	‡1/−	‡1/−	Hong Kong and China Ord.	¼—¾	...
5,600,000	Oct. 23	12	4	Imperial Continental Cap.	70—80	−2½
172,810	July 31	3½	3½	Do. 3½ p.c. Red. Deb.	81—86	...
63,480	June 19	3	3	Maidstone 3 p.c. Deb. ...	57—62	...
45,000		†10	†8	Malta & Mediterranean ...	95—102*	...
				Metropolitan (of Melbourne) ...		
392,000	Oct. 2	5½	5½	5½ p.c. Red. Deb.	95—100	...
231,977	Aug. 21	5	5	M.S. Utility 'C' Cons.	75—80	...
968,658	"	4	4	Do. 4 p.c. Cons. Pref. ...	70—80	...
390,076	June 19	4	4	Do. 4 p.c. Deb. ...	75—85	...

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 15.	Rise or Fall on Week.
148,955	June 19	5	5	M.S. Utility 5 p.c. Deb. ...	90—100	...
125,000	July 3	3½	3½	Do. 3½ p.c. Red. Bds. ...	92—95	...
675,000	Nov. 6	†3	†4	Montevideo, Ltd.	50—60	...
250,000	Aug. 21	7½	7½	North Middlesex 6 p.c. Con. ...	105—115	...
396,160	July 31	5	5	Northampton 5 p.c. max. ...	88—93	...
300,000	Nov. 6	†7	9	Oriental, Ltd.	118—128	...
468,537	Dec. 11	8	7	Plymouth & Stonehouse 5 p.c.	98—103*	−4½
621,667	July 31	8½	8½	Portsmouth & Gosport Cons.	112—117	...
241,446	"	5	5	Do. 5 p.c. max.	80—90	+½
73,350	"	5	5	Do. 5 p.c. Pref.	80—90	...
75,000	"	4	4	Do. 4 p.c. Pref.	70—80	...
114,000	July 31	5	5	Preston 5 p.c. Pref. ...	90—100	...
247,966	June 19	4	4	Primitiva 4 p.c. Cons. Deb. ...	95—100	...
625,959	July 17	4	4	Do. 4 p.c. Red. Deb. ...	93—98	...
15,000	Sept. 4	6	6	San Paulo 6 p.c. Cum. Pref. ...	7½—8½	...
441,275	Oct. 9	1/1½	1/1½	Severn Val. Gas Cor. Ld. Ord.	16/——19/—	...
460,810	Oct. 2	−/10⅔	−/10⅔	" " 4½ p.c. Cum. Pref. ...	17/——19/—	...
133,201	Aug. 21	5	8½	Shrewsbury 5 p.c. Ord. ...	107—117	...
9,000	June 5	†4	†4	South African Ord.	4—5	...
1,996,297	Aug. 21	1/2⅜	1/2⅜	South East'n Gas Cn. Ld. Ord.	15/6—17/6	...
1,000,000	"	−/10⅔	−/10⅔	Do. 4½ p.c. Red. Cum. Pref.	17/——19/—	...
769,191	"	4	4	Do. 4 p.c. Cum. Pref. ...	14/6—16/6	...
150,000	"	3½	3½	Do. 3½ p.c. Red. Deb. ...	90—95	...
6,709,895	July 31	6	5	South Met. Ord.	61—66	...
1,135,812	"	6	6	Do. 6 p.c. Irred. Pref. ...	97—102	...
850,000	"	4	4	Do. 4 p.c. Irred. Pref. ...	73—78	...
1,895,445	June 19	3	3	Do. 3 p.c. Deb.	63—68	...
1,000,000	July 17	5	5	Do. 5 p.c. Red. Deb. ...	97—102	...
600,000	"	3¾	3¾	Do. 3¾ p.c. Red. Deb. ...	92—97	...
1,543,795	July 31	6	6	South Suburban Ord. 5 p.c. ...	78—83	...
512,925	"	5	5	Do. 5 p.c. Pref.	87—97	...
500,000	"	4	4	Do. 4 p.c. Pref.	70—80	...
250,000	"	3¾	3¾	Do. 3¾ p.c. Red. Pref. ...	85—90	...
888,587	Dec. 11	5	5	Do. 5 p.c. Deb.	93—98*	+½
250,000	"	4	4	Do. 4 p.c. Deb.	78—83*	+½
200,000	July 31	3	3½	Do. 3½ p.c. Red. Deb. ...	85—90	...
427,859	Sept. 18	1/2⅜	9⅜	S. Western Gas & Water Ord.	14/——16/—	...
160,523	Oct. 9	−/10⅜	−/10⅜	Do. 4½ p.c. Red. Cum. Pref.	17/6—19/6	...
110,000	June 5	4	4	Do. 4 p.c. Red. Deb. ...	92—97	...
750,541	July 31	5½	5	Southampton Ord. 5 p.c. ...	75—85	...
148,836	June 5	4	4	Do. 4 p.c. Deb.	75—85	...
350,000	July 31	5½	5½	Swansea 5½ p.c. Red. Pref. ...	90—100	...
200,000	June 19	3½	3½	Do. 3½ p.c. Red. Deb. ...	90—100	...
1,076,490	July 31	6½	6½	Tottenham and District Ord....	85—95	...
409,835	"	5½	5½	Do. 5½ p.c. Pref.	95—105	...
62,235	"	5	5	Do. 5 p.c. Pref.	85—95	...
453,380	Dec. 11	4	4	Do. 4 p.c. Deb.	78—83*	−2
1,247,505	Oct. 23	6	4	U. Kingdom Gas Cor. Ord. ...	13/——16/—	...
1,085,952	Nov. 20	4½	4½	Do. 4½ p.c. 1st Cum. Pref. ...	14/——16/—	...
772,709	"	4	4	Do. 4 p.c. 1st Red. Cum. Pf.	14/6—16/6	...
745,263	June 5	4½	4½	Do. 4½ p.c. 2nd Non-Cum. Pf.	12/6—14/6	...
1,093,656	Sept 18	3½	3½	Do. 3½ p.c. Red. Deb. ...	85—95	...
378,106	Mar. 6	7	7	Uxbridge, &c., 5 p.c.	90—100	...
133,010	"	5	5	Do. 5 p.c. Pref. ...	95—105	...
1,371,138	July 31	7	6½	Wandsworth Consolidated ...	88—93	...
2,525,768	"	4	4	Do. 4 p.c. Pref.	73—78	...
1,343,964	June 19	5	5	Do. 5 p.c. Deb.	92—102	...
383,745	"	4	4	Do. 4 p.c. Deb.	75—85	...
400,000	"	3¾	3¾	Do. 3¾ p.c. Red. Deb. ...	92—97	...
558,342	July 31	6¾	6¾	Watford and St. Albans Ord. ...	90—100	...
200,000	"	5	5	Do. 5 p.c. Pref.	85—95	...
200,000	"	5½	5½	Do. 5½ p.c. Pref.	90—100	...
200,000	"	4	4	Do. 4 p.c. Rd. Pf. (1973/8)	85—90	...
100,000	"	—	33/4§	Do. 4 p.c. Red. Pf. (1959)	95—100	...
200,000	Dec. 11	3½	3½	Do. 3½ p.c. Red. Deb. ...	83—88*	−2

a.—The quotation is per £1 of Stock. * Ex. Div. † Paid free of income-tax. ‡ For year. § Actual.

Supplementary List and Provincial Exchanges overleaf.

STOCK AND SHARE LIST—Contd.

Supplementary List, not Officially Quoted, London

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Nominal Quotations Dec. 15	Rise or Fall on Week.
202,152	Sept. 4	5	5	Ascot Ord.	80—90	...
128,182	July 3	5	5	Do. 5 p.c. Pref. ...	90—95	...
31,035	Aug. 21	-/4⅛	-/4⅛	Associated Utilities 4 p.c. Pref.	15/—17/-	...
100,000	June 19	3⅛	3⅛	Do. 3⅛ p.c. Red. Deb. ...	90—95	...
17,000	Aug. 21	8	8	Bognor Orig. Ord. 'A' ...	105—115	...
62,210	,,	8	8	Do. New Add. 'A' ...	105—115	...
87,160	,,	7	7	Do. New 7 p.c. max. ...	100—110	...
37,440	July 31	10	10	Cam. Univ. & Town 10 p.c. max.	110—120	...
125,970	,,	7	7	Do. 7 p.c. max.	90—100	...
39,025	,,	5	5	Do. 5 p.c. max.	80—90	...
96,410	July 17	4½	4½	Cardiff 4½ p.c. Pref.	92—97	...
55,520	July 31	6	6	Colchester 6 p.c. Pref. ...	95—100	−7½
90,550	Sept. 18	5	5	Do. 5 p.c. Deb. ...	100—105	...
150,000	July 31	4	4	Croydon 4 p.c. Pref.	70—75	...
130,000	June 19	4	4	Do. 4 p.c. Deb.	75—80	...
65,000	Aug. 21	7½	7½	Eastbourne 'A' 5 p.c.	105—115	...
198,000	,,	6	6	Do. 'B' 3½ p.c.	90—100	...
112,312	,,	5	5	Do. 5 p.c. Pref.	90—95	...
130,000	June 19	5	5	Do. 5 p.c. Deb.	95—105	...
130,500	Aug. 10	7½	7½	Exeter New Ord. (£10) ...	10—12	...
24,000	Aug. 21	8½	8½	Gt. Yarmouth 8½ p.c. max. (£30)	15—20	...
59,400	,,	7½	7½	Do. 7½ p.c. max. (£30) ...	10—15	...
51,160	Dec. 11	5½	5½	Do. 5½ p.c. Deb.	102—107*	−½
152,600	Sept. 4	9	8	Guildford Cons.	110—120	...
54,055	,,	5	5	Do. 5 p.c. Pref.	90—95	...
68,250	Dec. 11	5	5	Do. 5 p.c. Deb.	90—95*	−7
156,600	Aug. 21	7	7	Hampton Court Cons. ...	100—110	...
86,046	June 19	‡4½	‡5	Holyh'd&N.W.G.&W.Cpn.Ord.	13/6—15/6	...
80,000	Aug. 21	4	4	Lea Bridge 4 p.c. Pref.	65—75	...
60,000	,,	6	6	Do. 6 p.c. Pref.	105—115	...
94,876	June 5	4	4	Do. 4 p.c. Deb.	75—80	...
73,620	Sept. 18	8¾	8¾	Luton Cons. 'A'	115—125	...
107,960	Sept. 18	5½	4	Mid Kent Ord. (£10)	7½— 8½	...
230,940	July 31	10	10	Oxford & District Ord. ...	135—145	+5
47,112	,,	5	5	Do. 5 p.c. Pref.	85—95	...
50,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	100—105	...
126,193	Oct. 30	7½	7½	Peterborough Ord.	140—150	...
64,990	Sept. 18	7½	7	Redditch Ord.	100—110	...
166,850	July 31	8	8	Romford Ord.	110—120	...
60,000	,,	4	4	Do. 4 p.c. Pref.	85—90	...
44,000	Sept. 18	5	5	Do. 5 p.c. Deb.	95—100	...
28,570	July 31	5½	5½	Rugby 5½ p.c. Pref.	95—105	...
25,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	100—105	...
42,750	Dec. 11	5½	5½	Do. 5½ p.c. Deb.	103—108*	−2
110,950	Aug. 21	8	8	Ryde Ord.	110—120	...
270,086	Sept. 4	7	7	Slough Ord.	100—110	...
21,000	Dec. 11	5	5	Do. 5 p.c. Deb.	92—97*	−3
28,872	Nov. 6	5½	5½	S. Midland Gas Cpn. Ltd. Ord.	14/—16/-	...
28,866	Sept. 18	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	14/—16/-	...
117,228	Aug. 21	7	5	Swindon Cons.	70—80	...
60,425	June 5	5	5	Do. 5 p.c. Deb.	95—100	...
64,380	June 19	5	5	Torquay & Paignton 5 p.c. Pref.	85—90	...
130,000	Aug. 21	8	5	Wakefield Ord.	85—95	...
81,650	,,	5	5	Do. 5 p.c. max.	75—80	...
82,000	July 31	6	6	Weymouth Ord.	80—90	...
273,626	Aug. 21	7	7	Wolverhampton Cons. Ord. ...	95—105	...
98,384	,,	6	6	Do. 6 p.c. Pref.	105—115	...
160,000	June 19	5½	5½	Do. 5½ p.c. Red. Deb. ...	100—105	...
106,490	Aug. 21	5½	5½	Wrexham Ord.	70—80	...
90,000	June 19	5	5	York 5 p.c. Red. Deb.	97—102	...
133,640	July 31	6½	6	Yorktown (Cam.) 5 p.c. Cons.	80—90	...
120,000	,,	5	5	Do. 5 p.c. Pref.	85—95	...
35,000	June 19	5½	5½	Do. 5½ p.c. Deb.	105—110	...

BRISTOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 15	Rise or Fall on Week
347,756	July 31	6	5	Bath Cons.	107—112	...
1,667,250	,,	5	5	Bristol, 5 p.c. max.	97—100	–
120,420	June 5	4	4	Do. 1st 4 p.c. Deb. ...	89—93	...
415,250	,,	4	4	Do. 2nd 4 p.c. Deb. ...	89—93	...
328,790	,,	5	5	Do. 5 p.c. Deb.	110—113	...
274,000	July 31	5	5	Newport (Mon.) Ord.	90—95	...
13,200	Sept. 4	8⅝	7	Pontyp'l Gas & W. 10 p.c. 'A'	12—13	...
13,600	,,	6	5	Do. 7 p.c. 'B'	10½—11	...
40,000	,,	6	5	Do. 7 p.c. 'C'	10½—11	...
140,778	July 31	5	5	Weston-super-Mare Cons. ...	93—98	...
64,338	June 19	4	4	Do. 4 p.c. Deb.	90—95	...
33,340	,,	7½	7½	Do. 7½ p.c. Deb.	140—150	...

LIVERPOOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 15	Rise or Fall on Week
157,150	July 31	6½	5	Chester 5 p.c. Ord.	100—103	...
92,500	June 5	4	4	Do. 4 p.c. Pref.	75—85	...
36,430	,,	3½	3½	Do. 3½ p.c. Deb.	86—89	...
41,890	,,	4	4	Do. 4 p.c. Red. Deb. ...	96—100	...
2,167,410	Aug. 21	6	6	Liverpool 5 p.c. Ord. ...	99—101	...
245,500	June 19	5	5	Do. 5 p.c. Red Pref. ...	95—100	+5
306,083	July 17	4	4	Do. 4 p.c. Deb.	99—101	...
106,280	July 31	10	10	Preston 'A' 10 p.c.	174—184	...
188,219	,,	7	7	Do. 'B' 7 p.c.	126—136	...

NEWCASTLE EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 15	Rise or Fall on Week
122,577	Aug. 21	8	8	Blyth 5 p.c. Ord.	115—120	...
732,000	Aug. 21	3	4	Hartlepool G. & W. Cn. & New	65—66	...
2,061,315	July 31	5¾	5	Newcastle & Gateshead Con.	18/6—19/-a	...
682,856	,,	4	4	Do. 4 p.c. Pref.	87—89	...
776,706	June 5	3½	3½	Do. 3¾ p.c. Deb.	79—81	...
277,285	April 24	5	5	Do. 5 p.c. Deb. '43 ...	98—103	...
332,351	Aug. 21	6	6	Sunderland 6 p.c. max. ...	110—120	...

NOTTINGHAM EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 15	Rise or Fall on Week
542,270	Aug. 10	9	6	Derby Con.	100—110	...
55,000	June 19	4	4	Do. 4 p.c. Deb.	100—105	...
20,000	June 19	5	5	Long Eaton 5 p.c. Pref. ...	9—11	...
80,000	,,	5	5	Do. 5 p.c. Deb. ...	100—105	...

SHEFFIELD EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 15	Rise or Fall on Week
10,000	Aug. 21	10	10	Great Grimsby 'A' Ord. ...	170—180	...
6,500	,,	10	10	Do. 'B' Ord. ...	170—180	...
79,000	,,	10	10	Do. 'C' Ord. ...	160—170	−2½
1,806,339	Feb. 20	6½	6½	Sheffield Cons.	119—122	...
95,000	July 3	4	4	Do. 4 p.c. Deb.	99—101	...

a The quotation is per £1 of Stock.
* Ex. div. ‡ For year.

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